

2011 ENGINE**Engine Mechanical - Outlander Sport & RVR****GENERAL INFORMATION**

The 4B11 (2.0 L) engine is an in-line four-cylinder engine. The cylinder numbers are assigned as 1-2-3-4 from the front of the engine (timing chain side). The firing order is 1-3-4-2.

GENERAL SPECIFICATIONS

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Item			Specification
Type			In-line DOHC
Number of cylinders			4
Bore mm (in)			86 (3.39)
Stroke mm (in)			86 (3.39)
Total displacement cm ³ (cu. in)			1,998 (121.9)
Compression ratio			10.0
Firing order			1-3-4-2
Valve timing	Intake valve	Opens (BTDC)	3° - 28°
		Closes (ABDC)	45° - 20°
	Exhaust valve	Opens (BBDC)	41° - 21°
		Closes (ATDC)	3° - 23°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type

ENGINE DIAGNOSIS**ENGINE DIAGNOSIS**

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 pressure	Engine oil level is too low	Check the engine oil level.
	Malfunction of engine oil pressure switch	Replace the engine oil pressure switch.
	Clogged oil filter	Install a new filter.
	Worn oil pump gears or cover	Replace the gears and/or the cover.
	Thin or diluted engine oil	Change the engine oil to the correct viscosity.
	Stuck (opened) oil relief valve	Repair the relief valve.

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	Excessive bearing clearance	Replace the bearings.
Engine oil pressure too high	Stuck (closed) oil relief valve	Repair the relief valve.
Noisy valves	Incorrect valve clearance	Adjust valve clearance
	Thin or diluted engine oil (low engine oil pressure)	Change the engine oil.
	Worn or damaged valve stem or valve guide	Replace the valve and/or the guide.
Connecting rod noise/main bearing noise	Insufficient oil supply	Check the engine oil level.
	Thin or diluted engine oil	Change the engine oil.
	Excessive bearing clearance	Replace the bearings.

SERVICE SPECIFICATIONS**SERVICE SPECIFICATIONS**

Item		Standard value	Limit
Drive belt tension	Vibration frequency Hz (Reference)	102 - 129	-
	Tension N (lb) (Reference)	248 - 400 (56 - 90)	-
Valve clearance (at cold) mm (in)	Intake valve	0.20 ± 0.03 (0.008 ± 0.0012)	-
	Exhaust valve	0.30 ± 0.03 (0.012 ± 0.0012)	-
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		700 ± 100	-
Compression pressure (at engine speed of 200 r/min) kPa (psi)		1,470 (213)	Minimum 1,050 (152)
Compression pressure difference of all cylinder kPa (psi)		-	98 (14)
Intake manifold vacuum at curb idle kPa (in Hg)		-	Minimum 60 (18)

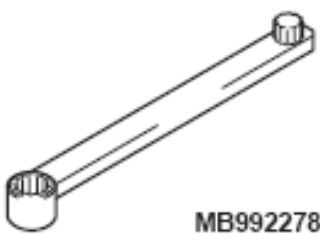

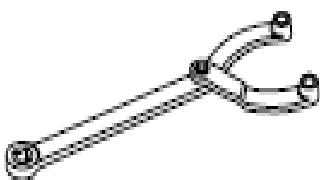
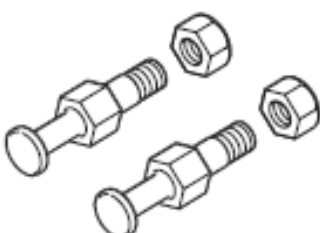
SEALANTS AND ADHESIVE**SEALANTS AND ADHESIVE SPECIFICATION**

Item	Specified sealant and adhesive	Remark
Rocker cover assembly (matching area of the cylinder head and the timing chain case)	ThreeBond 1227D, ThreeBond 1217G (Mitsubishi Genuine Part No. 1000A923), LOCTITE 5900 or equivalent	Semi-drying sealant
Engine oil pan	ThreeBond 1227D, ThreeBond 1217G (Mitsubishi Genuine Part No. 1000A923), ThreeBond 1207F (Mitsubishi Genuine Part No. 1000A992), LOCTITE	

	5970, LOCTITE 5900 or equivalent	
Flywheel bolt < M/T > or drive plate bolt < CVT >	ThreeBond 1324 or equivalent	Anaerobic adhesive
Cylinder head gasket (matching area of the cylinder head, cylinder head gasket and the cylinder block)	ThreeBond 1217G (Mitsubishi Genuine Part No. 1000A923), LOCTITE 5900 or equivalent	Semi-drying sealant
Timing chain case assembly		



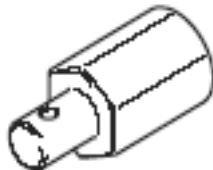
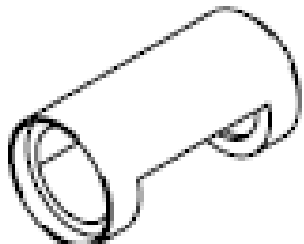
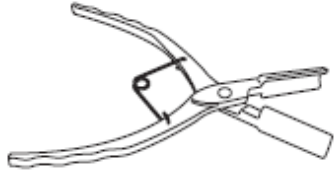
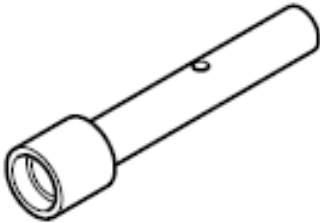
SPECIAL TOOLS

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
 MB992278	MB992278 Belt tension release wrench	-	Drive belt auto-tensioner tension release
 A B B992080	MB992080 Belt tension meter set a. MB9912081 Belt tension meter b. MB992082 Microphone assembly	Tool not available	Drive belt tension check
 B990767	MB990767 Front hub and flange yoke holder	MB990767-01	Holding the crankshaft pulley
	MD998719 Pin	MIT308239	

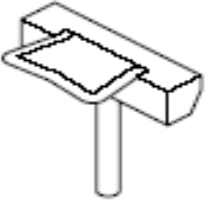

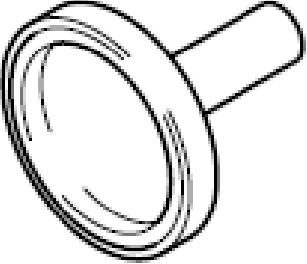
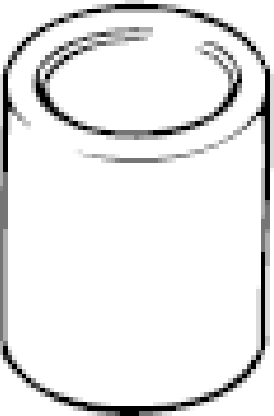
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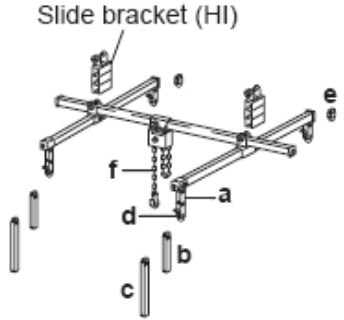
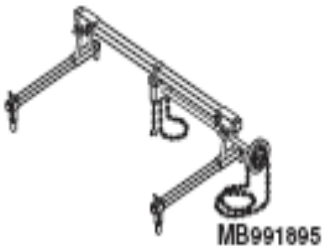
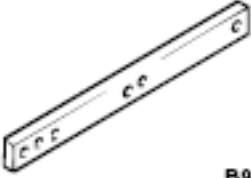
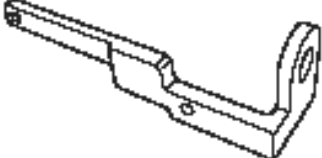
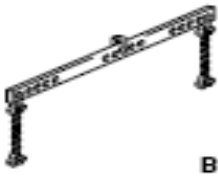
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 B992103	MB992103 Chain tension release bar	-	Camshaft and camshaft sprocket assembly (exhaust side) removal
 MD998772	MD998772 Valve spring compressor	General service tool	Valve spring compression
 B992090	MB992090 Retainer holder attachment	-	
	MB992089 Retainer holder C	-	
	MB992085 Valve stem seal pliers	-	Valve stem seal removal
	MD998737 Valve stem seal installer	MD998737-01	Valve stem seal press-fitting
	MD998727 Oil pan FIPG cutter	MD998727-01	Engine oil pan removal

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 <p>D998727</p>			
 <p>MB991883</p>	<p>MB991883 Flywheel stopper</p>	<p>General service tool</p>	<p>Supporting the flywheel < M/T > or drive plate < CVT ></p>
	<p>MD998718 Crankshaft rear oil seal installer</p>	<p>MD998718-01</p>	<p>Press-fitting the crankshaft rear oil seal</p>
	<p>MB991448 Bush remover and installer base</p>	<p>MB991448-01</p>	<p>Press-fitting the crankshaft front oil seal</p>
	<p>MB991928 Engine hanger</p> <ul style="list-style-type: none"> a. MB991929 Joint (50) x 2 b. MB991930 Joint (90) x 2 c. MB991931 Joint (140) x 2 	<p>Tool not available</p>	

 <p>Slide bracket (HI)</p> <p>B991828</p>	<p>d. MB991932 Foot (standard) x 4</p> <p>e. MB991933 Foot (short) x 2</p> <p>f. MB991934 Chain and hook assembly</p>		
 <p>MB991895</p>	<p>MB991895 Engine hanger</p>	<p>Tool not available</p>	<p>Supporting the engine assembly</p>
 <p>B991527</p>	<p>MB991527 Hanger</p>	<p>Tool not available</p>	
 <p>B992201</p>	<p>MB992201 Engine hanger plate</p>	<p>-</p>	
 <p>B991454</p>	<p>MB991454 Engine hanger balancer</p>	<p>MZ203827-01</p>	<p>Supporting the engine assembly</p> <p>NOTE: Special tool MB991454 is a part of special tool engine hanger attachment set MB991453.</p>

ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK

1. Remove the radiator condenser tank mounting bolt, and move the radiator condenser tank to a place where it does not interfere with the drive belt tension check (Refer to **RADIATOR**).

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

2. Make sure that the indicator mark on the auto-tensioner is within the area marked with A in the illustration.
3. If the mark is out of the area A, replace the drive belt (Refer to **REMOVAL AND INSTALLATION**).

NOTE: The drive belt tension adjustment is not necessary as the auto-tensioner is adopted.

4. Install the radiator condenser tank to the original position (Refer to **RADIATOR**).

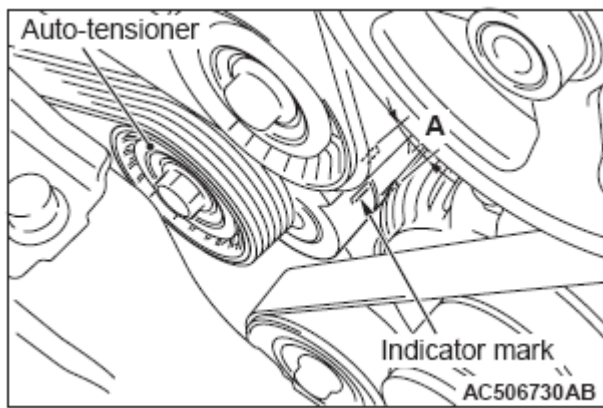


Fig. 1: Checking Drive Belt Tension

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

DRIVE BELT AUTO-TENSIONER CHECK

OPERATION CHECK

Required Special Tool:

MB992278: Belt tension release wrench

1. Stop the engine from the idle state.
2. Remove the radiator condenser tank mounting bolt, and move the radiator condenser tank to a place where it does not interfere with the auto-tensioner check (Refer to **RADIATOR**).
3. Check that the drive belt are not protruding from the pulley width of drive belt auto-tensioner.
4. Remove the drive belt (Refer to **REMOVAL AND INSTALLATION**).

WARNING: Always work from above when releasing the tension of the auto-tensioner. When you try to gain access from underneath the vehicle, you will experience difficulty, thus causing the tool to be dropped off.

CAUTION: To work at the optimum angle, you must choose a most suitable box-type wrench is applied to the special tool.

WARNING: Be sure to set the box-type wrench and the special tool to the hexagonal parts securely to prevent the tool from falling off because the tension of the auto-tensioner is high.

5. Install special tool MB992278 and a box-type wrench at the optimum angle.
6. Check that no binding is present by turning the auto-tensioner in the left and right directions.
7. If there are any problems in the procedure 3 or 6, replace the drive belt auto-tensioner (Refer to **REMOVAL AND INSTALLATION**).
8. Install the drive belt (Refer to **REMOVAL AND INSTALLATION**).
9. Install the radiator condenser tank to the original position (Refer to **RADIATOR**).

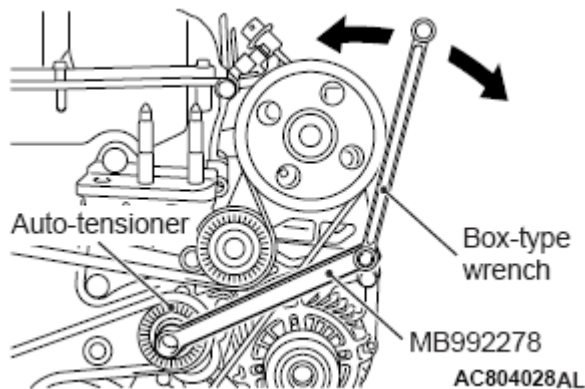


Fig. 2: Checking Drive Belt Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

FUNCTION CHECK

The drive belt auto-tensioner can be checked whether it is in good condition by checking its tension.

< When the vibration frequency is measured: Recommendation >

Required Special Tools:

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

1. Check the tension of the drive belt (Refer to **DRIVE BELT TENSION CHECK**).
2. Check the tension of the drive belt in the following procedures.
 1. Connect special tool MB992082 to special tool MB992081 of 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

Belt tension meter set (MB992080)

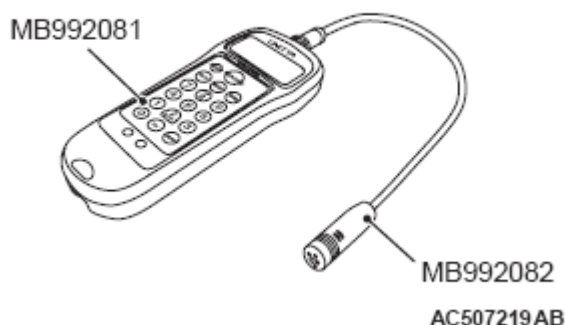


Fig. 3: Connecting Special Tool MB992082 To Special Tool MB992081 Of Special Tool MB992080

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

< Setting procedure >

- a. Press down the "MASS" button till the belt mass select display appears.
- b. Press the "UP" or "DOWN" button to select "01 1.5GT 0.9" and press the "MEASURE" button to decide it.
- c. Check to ensure that "M 000.9 g/m" is displayed.
- d. Press the "WIDTH" button to change to the belt width input display.
- e. 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.
- f. Press the "SPAN" button to change to the span length input display.

- g. 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:

- When measuring, make sure that the engine is cold.
 - Measure after turning the crankshaft clockwise one turn or more.
 - Do not allow any contaminants such as water or oil to get onto the microphone.
 - If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.
 - If the microphone is touching the belt while the measurement is being made, the values measured by the microphone may not correspond to actual values.
 - Do not take the measurement while the vehicle's engine is running.
5. Hold special tool MB992080 to the middle of the belt between the pulleys (at the place indicated by arrow) where it does not contact the belt [approximately 10 - 15 mm (0.4 - 0.59 inch) away from the rear surface of the belt] so that it is perpendicular to the belt (within an angle of ± 15 degrees angle).
6. Press the "MEASURE" button.
7. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow in the illustration) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

Standard value: 102 - 129 Hz

NOTE: To take the measurement repeatedly, tap the belt again.

8. Press and hold the "POWER" button to turn off the power supply.

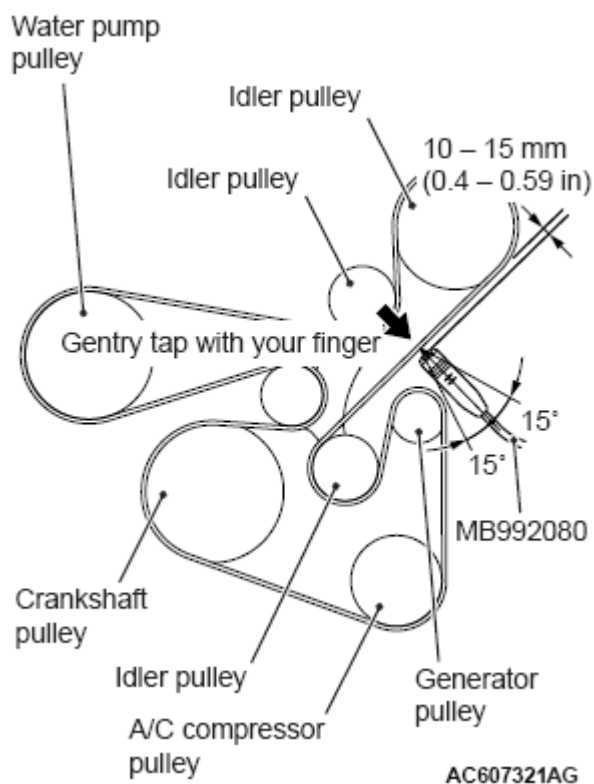


Fig. 4: Measuring Vibration Frequency Using Special Tool MB992080
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. If not within the standard value, replace the drive belt auto-tensioner (Refer to **REMOVAL AND INSTALLATION**).

< When using a tension gauge >

1. Check the tension of the drive belt (Refer to **DRIVE BELT TENSION CHECK**).

CAUTION:

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

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

Standard value: 248 - 400 N (56 - 90 pounds)

3. If not within the standard value, replace the drive belt auto-tensioner (Refer to **REMOVAL AND INSTALLATION**).

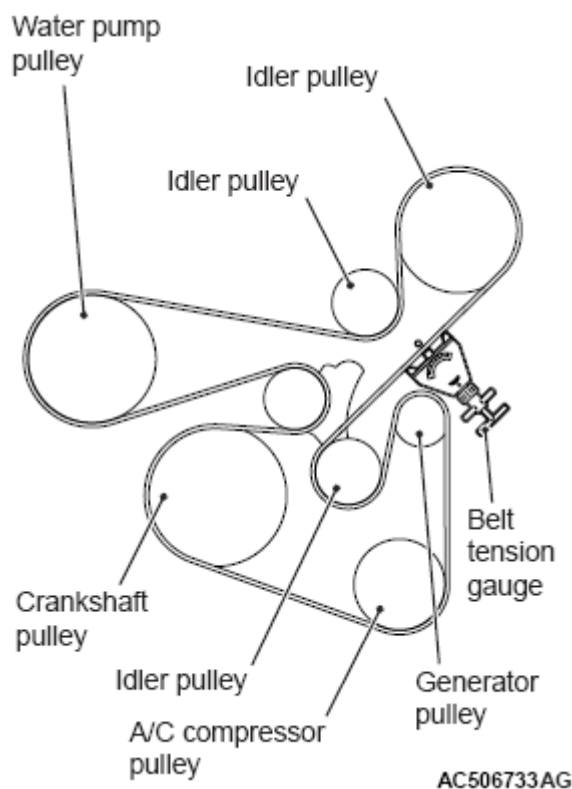


Fig. 5: Checking Tension Of Drive Belt

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

VALVE CLEARANCE CHECK AND ADJUSTMENT

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

IGNITION TIMING CHECK

Required Special Tool:

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

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

1. Before inspection, set the vehicle in the following condition:

- Engine coolant temperature: 80 - 95°C (176 - 203°F)
- Lights and all accessories: OFF
- Transaxle: Neutral (P range on vehicles with CVT)

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.

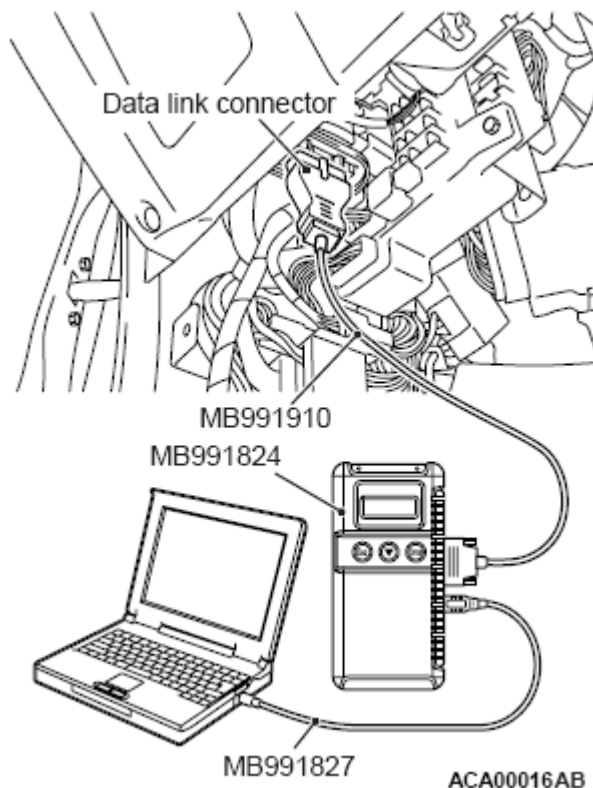


Fig. 6: Connecting Scan Tool To Data Link Connector
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 3) of the ignition coil No. 1.
4. Start the engine and run it at idle.
5. Check that the idle speed is approximately 700 r/min.
6. Select scan tool MB991958 actuator test "item number 11".
7. Check that basic ignition timing is within the standard value.

Standard value: 5° BTDC ± 3°

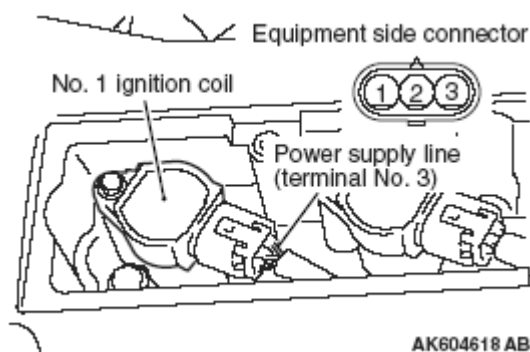


Fig. 7: Identifying Power Supply Line Connector Terminals
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. If the basic ignition timing is not within the standard value, check the following items:
- Diagnostic output
 - Timing chain cover and crankshaft position sensor installation conditions
 - Crankshaft sensing blade condition

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

9. Cancel the setting mode of the scan tool MB991958.
10. Check that the actual ignition timing is at the standard value.

Standard value: Approximately 10° BTDC

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

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

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

11. Remove the timing light.

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
- Transaxle: Neutral (P range on vehicles with CVT)

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.

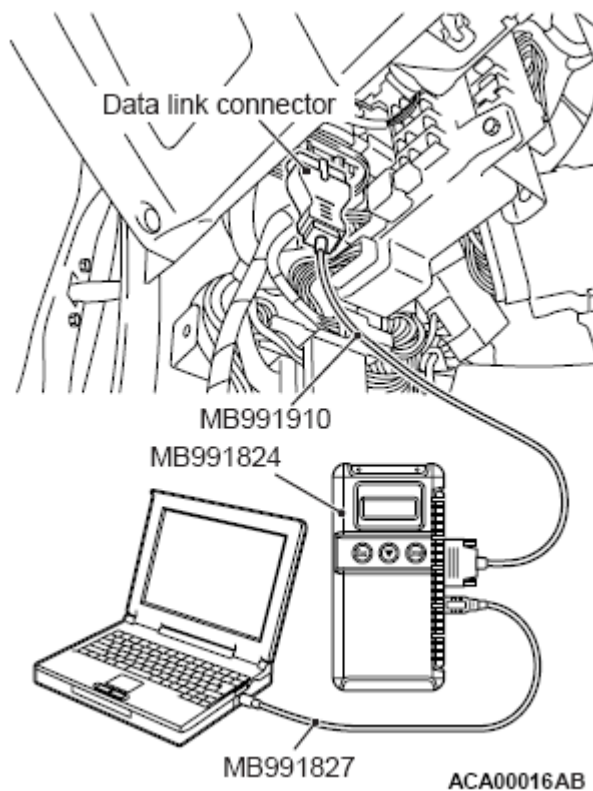


Fig. 8: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 3) of the ignition coil No. 1.
4. Start the engine.
5. Run the engine at idle for 2 minutes.
6. Check the actual ignition timing is at the standard value.

Standard value: Approximately 10° BTDC

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

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

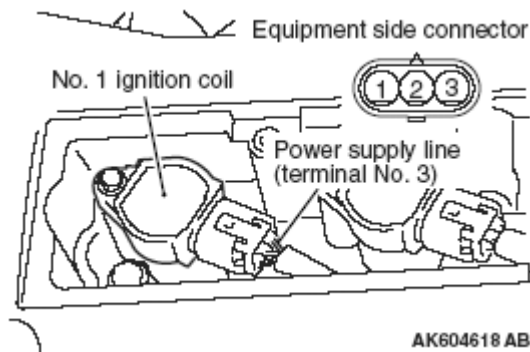


Fig. 9: Identifying Power Supply Line Connector Terminals
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

Curb idle speed: 700 ± 100 r/min

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

8. If the idle speed is outside the standard value, refer to SYMPTOM CHART.
9. 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.

10. 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

- Transaxle: Neutral (P range on vehicles with CVT)

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.

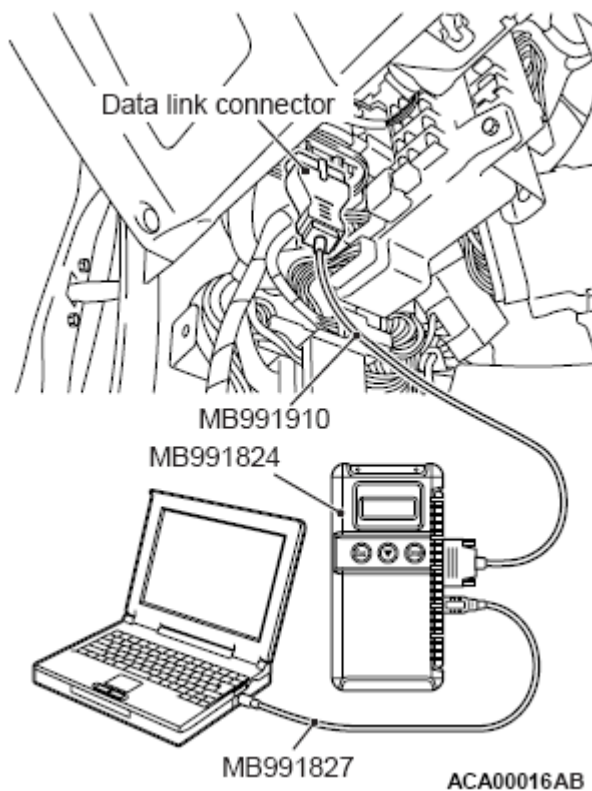


Fig. 10: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 3) of the ignition coil No. 1.
4. Start the engine and let it run at idle.
5. Check that the actual ignition timing is at the standard value.

Standard value: Approximately 10° BTDC

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

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

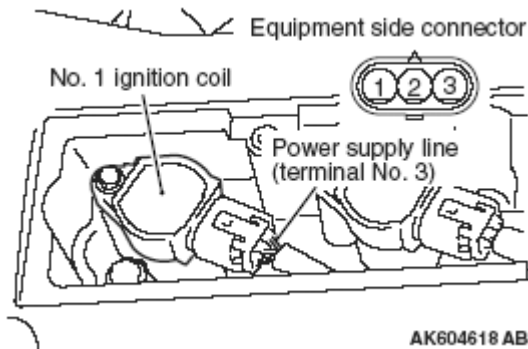


Fig. 11: Identifying Power Supply Line Connector Terminals
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

6. Run the engine and 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 there is a deviation from the standard value, inspect the MFI system (Refer to SYMPTOM CHART)
10. Remove the CO, HC tester and 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.

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: Neutral (P range on vehicles with CVT)

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. Turn the ignition switch to the "LOCK" (OFF) position.
3. Disconnect the connector of the ignition coil, and then remove all the ignition coils and the spark plugs.
4. Disconnect the all of the injector connectors.

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

5. Cover the spark plug hole with a shop towel etc., after the engine has been cranked, check that no foreign material is adhering to the shop towel.

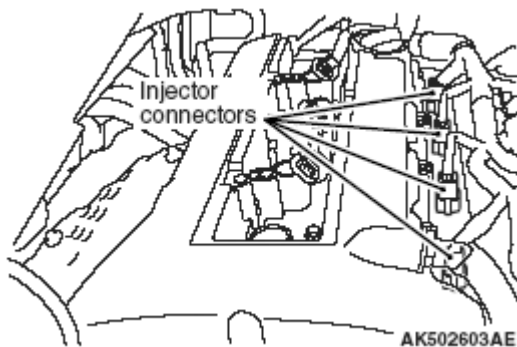


Fig. 12: Identifying Injector Connectors

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Set compression gauge to one of the spark plug holes.
7. Cranking the engine with the accelerator pedal fully depressed, measure the compression pressure.

Standard value (at engine speed of 200 r/min): 1,470 kPa (213 psi)

Limit (at engine speed of 200 r/min): Minimum 1,050 kPa (152 psi)

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

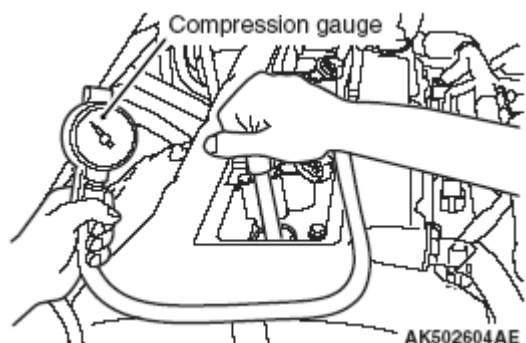


Fig. 13: Measuring Compression Pressure Of Cylinders
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Limit: Maximum 98 kPa (14 psi)

9. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps from 6 to 8.
 1. If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
 2. If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
10. Connect the all of the injector connector.
11. Install the spark plugs and ignition coils.
12. Use the scan tool MB991958 to erase the diagnosis codes.

NOTE: This will erase the diagnosis code resulting from the injector connectors being disconnected.

13. 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**)

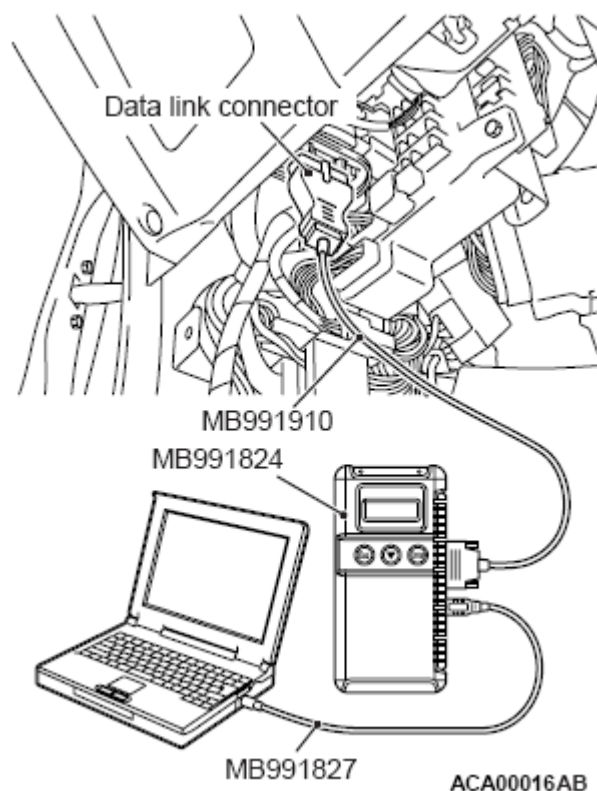


Fig. 14: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

MANIFOLD VACUUM CHECK

Required Special Tool:

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

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

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

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.

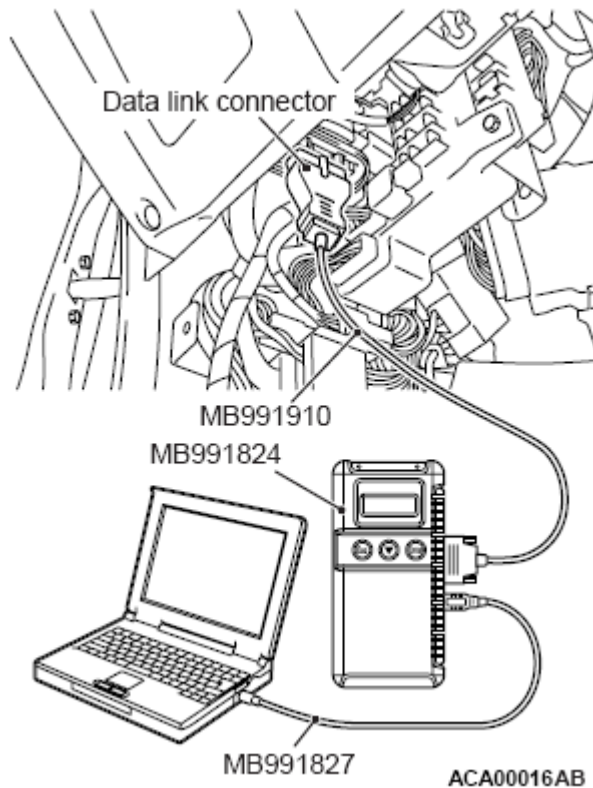


Fig. 15: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose. Plug the PCV valve.
4. Start the engine and check that idle speed is approximately 700 r/min.
5. Check the intake manifold vacuum.

Limit: Minimum 60 kPa (18 in Hg)

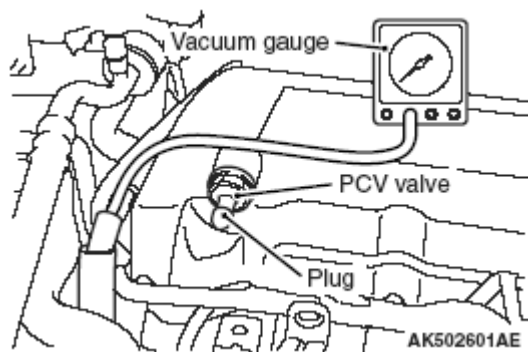


Fig. 16: Checking Intake Manifold Vacuum

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.

CRANKSHAFT PULLEY

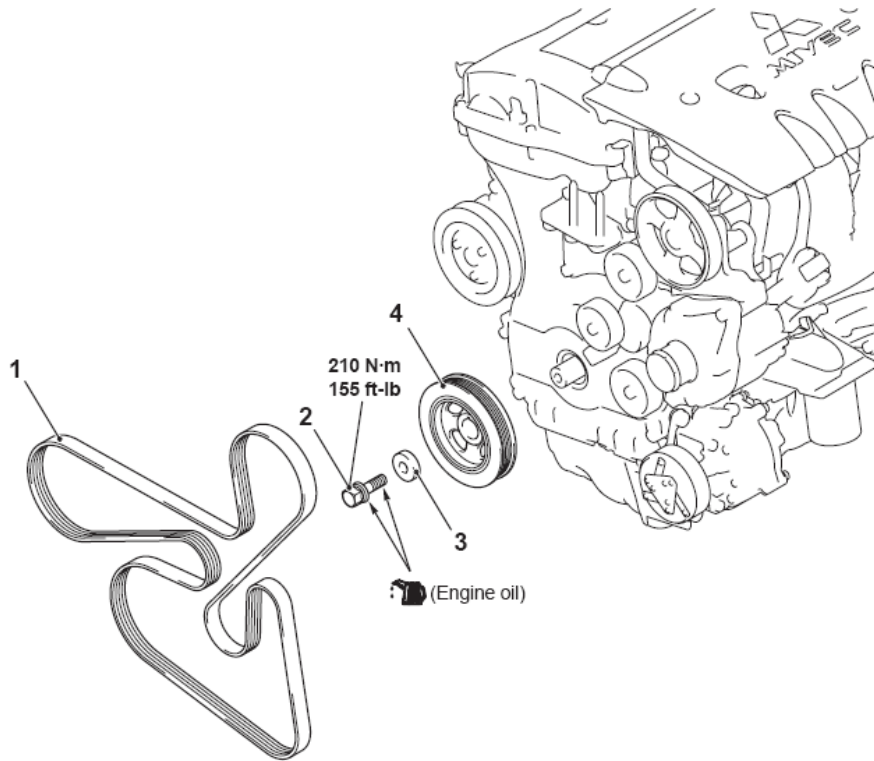
REMOVAL AND INSTALLATION

Pre-removal Operation

- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal

Post-installation Operation

- Drive Belt Tension Check
- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation



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- Removal steps**
- <<A>> • Radiator condenser tank
- <> >>B<< 1. Drive belt

- <<C>> >>A<< 2. Crankshaft pulley center bolt
- <<C>> >>A<< 3. Crankshaft pulley washer
- <<C>> >>A<< 4. Crankshaft pulley

Fig. 17: Identifying Crankshaft Pulley Remove/Install Components With Torque Specifications
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB992278: Belt Tension Release Wrench
- MB990767: Front Hub and Flange Yoke Holder
- MD998719: Pin

REMOVAL SERVICE POINTS

<< A >> RADIATOR CONDENSER TANK REMOVAL

Remove the radiator condenser tank mounting bolt, and move the radiator condenser tank to a place where it does not interfere with the drive belt removal and installation.

<< B >> DRIVE BELT REMOVAL

To introduce the serpentine drive system with the auto-tensioner, the following operations will be required.

CAUTION: To reuse the drive belt, draw an arrow indicating the rotating direction on the back of the belt using chalk to install the same direction.

WARNING: Always work from above when releasing the tension of the auto-tensioner. When you try to gain access from underneath the vehicle, you will experience difficulty, thus causing the tool to be dropped off.

CAUTION: To work at the optimum angle, you must choose a most suitable box-type wrench is applied to the special tool.

WARNING: Be sure to set the box-type wrench and the special tool to the hexagonal parts securely to prevent the tool from falling off because the tension of the auto-tensioner is high.

1. Install special tool MB992278 and a box-type wrench at the optimum angle.
2. Rotate the pulley bolt of the auto-tensioner counterclockwise.
3. Insert the L-shaped hexagon wrench into the auto-tensioner hole to fix the auto-tensioner.
4. Remove the drive belt.

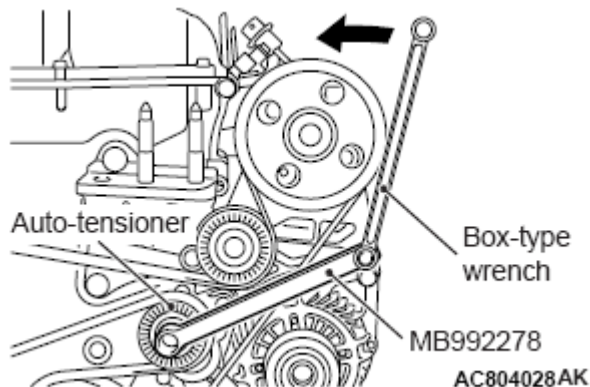


Fig. 18: Removing Drive Belt (1 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

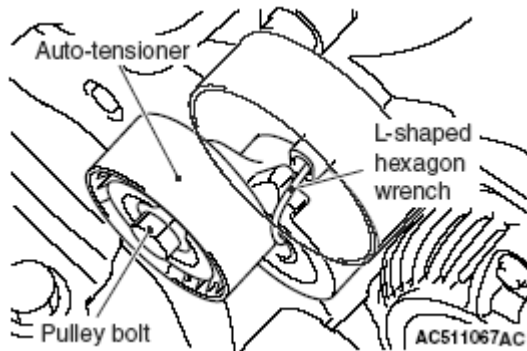


Fig. 19: Removing Drive Belt (2 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

1. Hold the crankshaft pulley with special tools MB990767 and MD998719.
2. Loosen the crankshaft pulley center bolt and remove the crankshaft pulley center bolt, crankshaft pulley washer and crankshaft pulley.

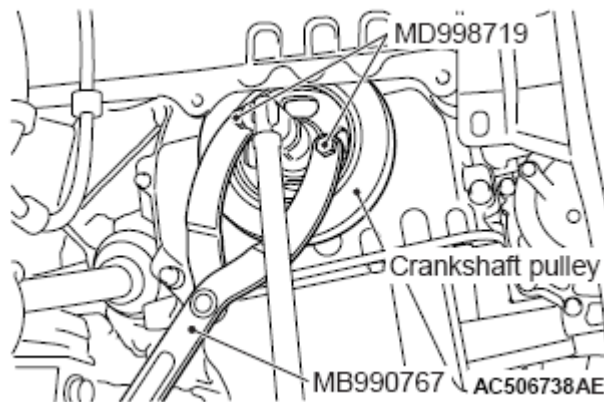


Fig. 20: Loosening Crankshaft Pulley Center Bolt

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

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

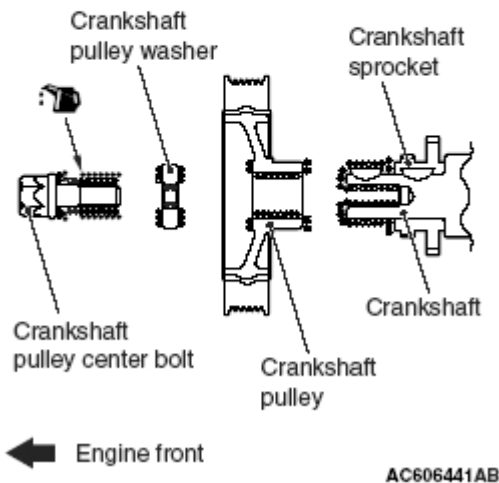
1. Wipe off the dirt on the crankshaft sprocket, crankshaft and crankshaft pulley as shown in the illustration using a rag, and then degrease the areas.

NOTE: **Degrease them to prevent drop in the friction coefficient of the pressed area which is caused by oil adhesion.**

2. Install the crankshaft pulley.

3. Wipe off the dirt on the crankshaft pulley washer and the crankshaft pulley center bolt as shown in the illustration using a rag.
4. Apply an adequate and minimum amount of engine oil to the thread of the crankshaft pulley center bolt and the lower area of the flange.

- : Wipe clean with a rag.
- * : Wipe clean with a rag and degrease.
- : Apply a small amount of engine oil.



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Fig. 21: Installing Crankshaft Pulley

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Hold the crankshaft pulley with special tools MB990767 and MD998719 in the same manner as removal.
6. Tighten the crankshaft pulley center bolt to the specified torque.

Tightening torque: 210 N.m (155 ft-lb)

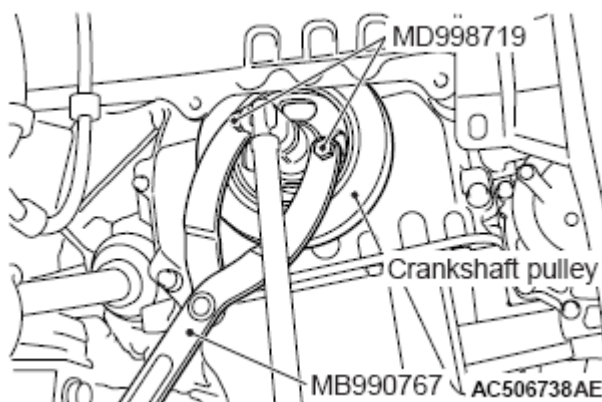


Fig. 22: Tightening Crankshaft Pulley Center Bolt

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << DRIVE BELT INSTALLATION

CAUTION:

- To reuse the drive belt, install it by aligning the arrow mark on the backside of belt marked at the removal with the rotating direction.
- Check that the notches of the notched pulley and the notches of the drive belt are fit correctly.
- Check that the drive belt is installed in the center of the flat surface of the flat pulley.

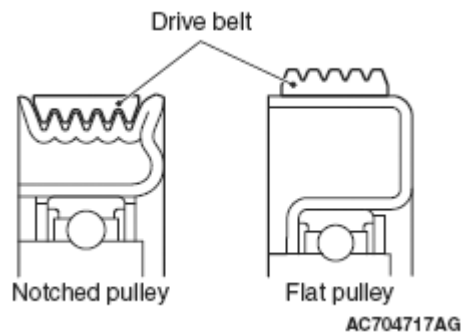


Fig. 23: Checking Drive Belt Installation

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

1. Install the drive belt to each pulley as shown in the illustration.

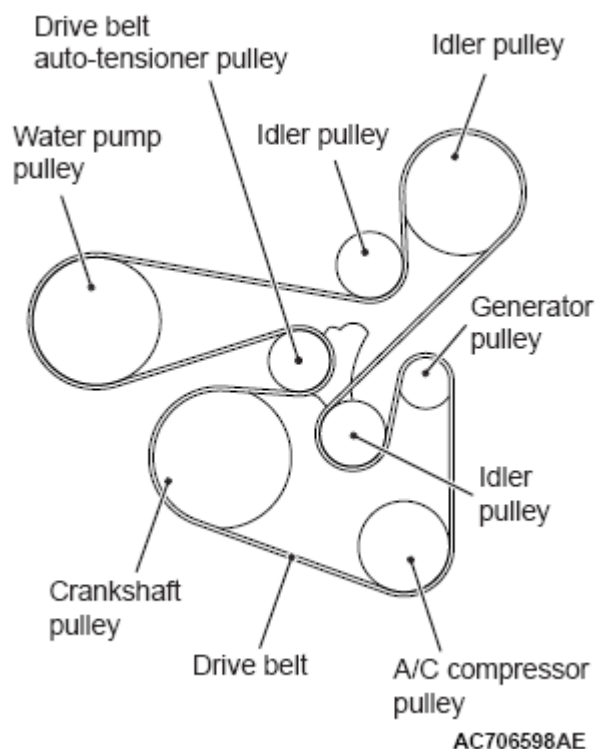


Fig. 24: Installing Drive Belt

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

WARNING: Always work from above when releasing the tension of the auto-tensioner. When you try to gain access from underneath the vehicle, you will experience difficulty, thus causing the tool to be dropped off.

CAUTION: To work at the optimum angle, you must choose a most suitable box-type wrench is applied to the special tool.

WARNING: Be sure to set the box-type wrench and the special tool to the hexagonal parts securely to prevent the tool from falling off because the tension of the auto-tensioner is high.

2. Install special tool MB992278 and a box-type wrench at the optimum angle.
3. Rotate the auto-tensioner counterclockwise and remove the L-shaped hexagon wrench fixing the auto-tensioner.
4. Apply tension to the drive belt while slowly turning the auto-tensioner clockwise.

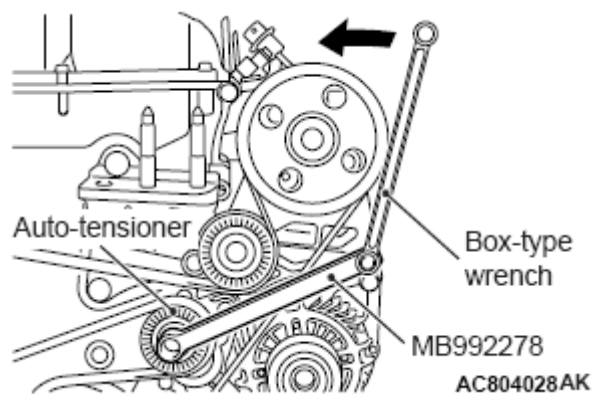


Fig. 25: Installing Special Tool MB992278 And Box-Type Wrench
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

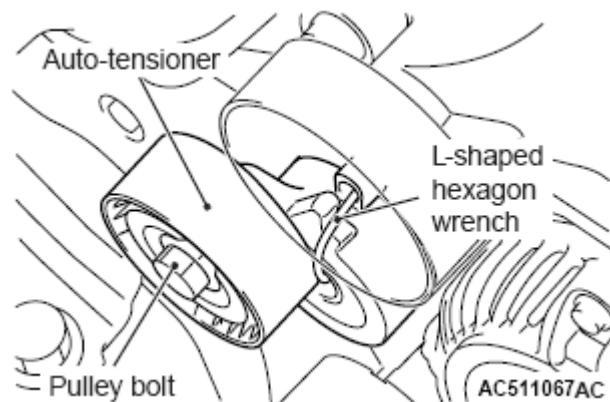
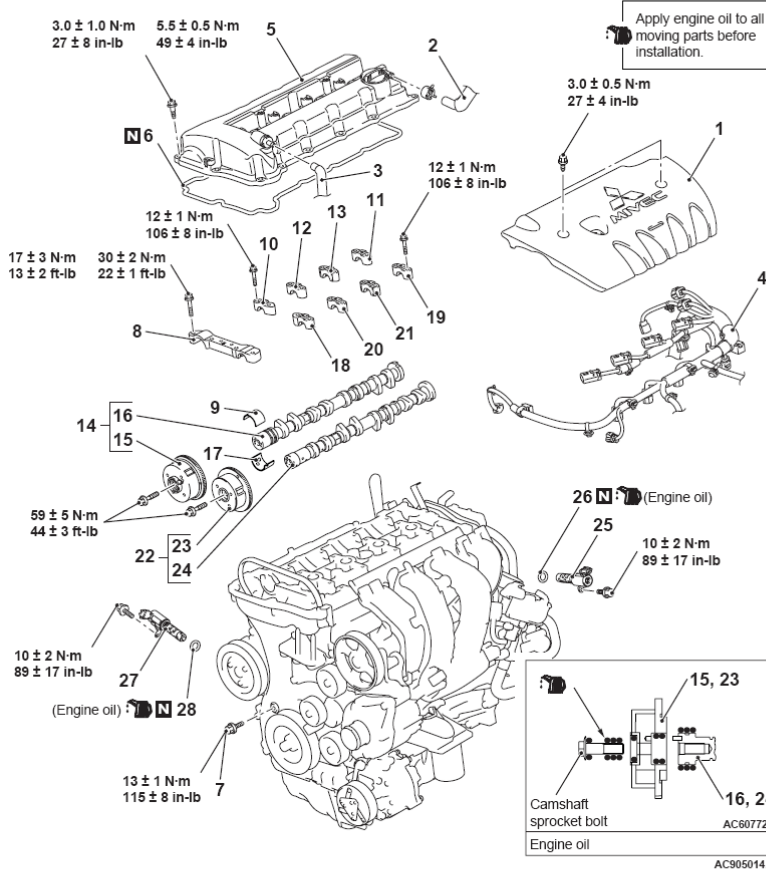


Fig. 26: Rotating Auto-Tensioner Counterclockwise
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAMSHAFT

REMOVAL AND INSTALLATION

Pre-removal Operation <ul style="list-style-type: none"> Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal Air Cleaner Assembly Removal 	Post-installation Operation <ul style="list-style-type: none"> Air Cleaner Assembly Installation Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation
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Camshaft removal steps

- Engine upper cover
- Ignition coil
- Rocker cover breather hose connection
- Rocker cover PCV hose connection
- Control wiring harness connection
- Rocker cover assembly
- Rocker cover gasket
- Number 1 cylinder compression top dead center setting (only at removal).
- Valve clearance adjustment (only at installation).
- Service hole bolt
- Camshaft and camshaft sprocket assembly (exhaust side) removal preparatory operation (only at removal)
- Camshaft bearing front cap assembly
- Camshaft bearing
- Camshaft bearing oil feeding cap (exhaust side)

Camshaft removal steps

- Camshaft bearing cap (exhaust side)
 - Camshaft bearing cap (exhaust side)
 - Camshaft bearing thrust cap (exhaust side)
 - Camshaft and camshaft sprocket assembly (exhaust side)
 - Camshaft sprocket (exhaust side)
 - Camshaft (exhaust side)
 - Camshaft bearing
 - Camshaft bearing oil feeding cap (intake side)
 - Camshaft bearing cap (intake side)
 - Camshaft bearing cap (intake side)
 - Camshaft bearing thrust cap (intake side)
 - Camshaft and camshaft sprocket assembly (intake side)
 - Camshaft sprocket (intake side)
 - Camshaft (intake side)
- Oil control valve removal steps**
- Engine upper cover
 - Intake oil feeder control valve
 - O-ring
 - Exhaust oil feeder control valve
 - O-ring

Fig. 27: Identifying Camshaft Remove/Install Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MB992103: Chain Tension Release Bar

REMOVAL SERVICE POINTS

<< A >> ROCKER COVER ASSEMBLY REMOVAL

Loosen the rocker cover assembly mounting bolts in the order of number shown in the illustration, and remove the rocker cover assembly.

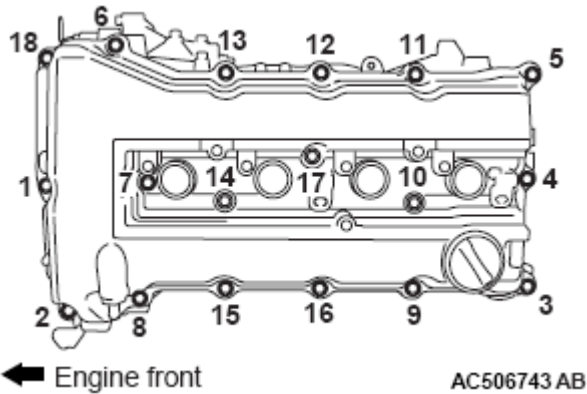


Fig. 28: Loosening Rocker Cover Assembly Mounting Bolts
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> NUMBER 1 CYLINDER COMPRESSION TOP DEAD CENTER SETTING

CAUTION: Turn the crankshaft clockwise.

1. Turn the crankshaft clockwise so that the camshaft sprocket timing marks become horizontal to the cylinder head upper surface, and set the number 1 cylinder to the top dead center of compression. At this time, check that the crankshaft pulley timing mark is in the "T" mark position of the ignition timing indicator of the timing chain case assembly.
2. Put paint marks on both the camshaft sprocket and valve timing chain at the position of camshaft sprocket timing chain mating mark (circular hole).

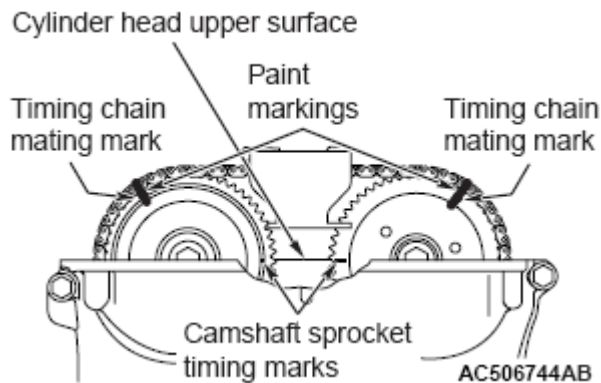


Fig. 29: Identifying Paint Marks On Camshaft Sprocket And Valve Timing Chain
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< C >> CAMSHAFT AND CAMSHAFT SPROCKET ASSEMBLY (EXHAUST SIDE) REMOVAL PREPARATORY OPERATION

1. Insert a precision flat-tipped screwdriver through the service hole of the timing chain case assembly, press up the timing chain tensioner ratchet to unlock, and keep the timing chain tensioner with that state.

NOTE: Lightly press down the tail end of the precision flat-tipped screwdriver to press up the tip of the precision flat-tipped screwdriver inserted to the timing chain tensioner to unlock.

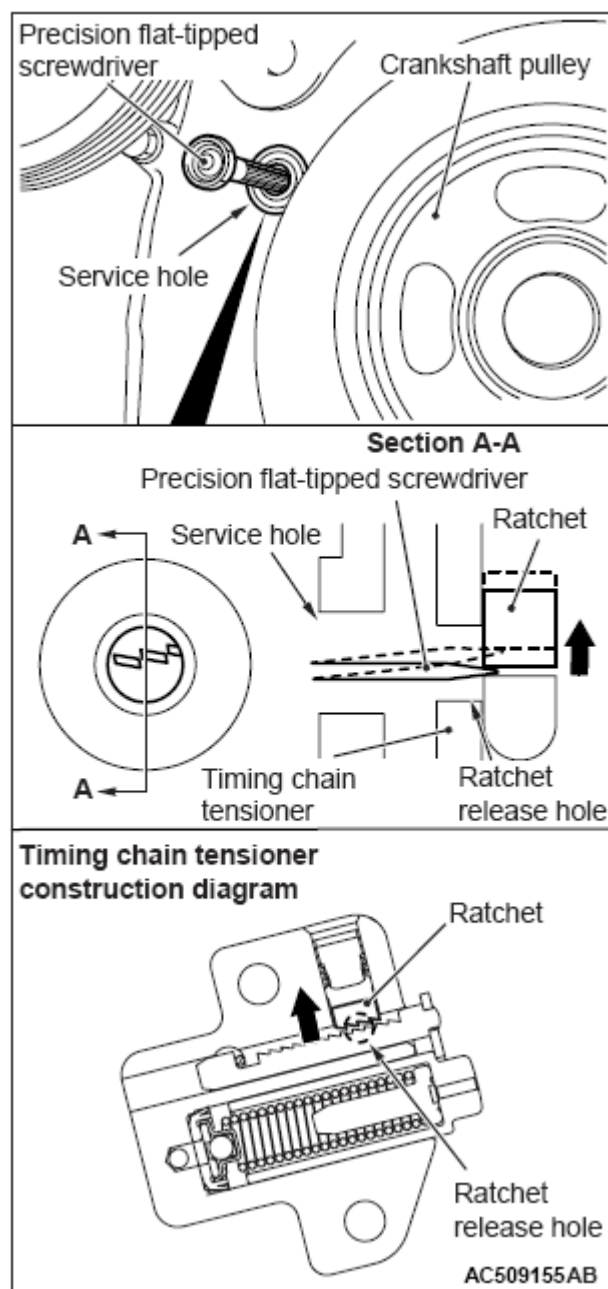


Fig. 30: Unlocking Timing Chain Tensioner

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION:

- When inserting the special tool into the timing chain case assembly inside, pay attention to the position of the valve timing chain to avoid damage to the valve timing chain and timing chain tension side guide. Do not insert the special tool beyond its insertion guideline.
- If unlocking the timing chain tensioner is insufficient, the special tool cannot be inserted to the insertion guideline. Do not

insert the special too forcibly, follow Step 1 again to unlock the timing chain tensioner and insert the special tool.

2. With the timing chain tensioner unlocked, insert special tool MB992103 from the timing chain case assembly inside along the tension side of the valve timing chain until the insertion guide line aligns with the upper surface of the timing chain case assembly (A in the illustration).

NOTE: With the timing chain tensioner unlocked, insert the special tool along the tension side of the valve timing chain, according to the special tool top shape. The special tool can be inserted smoothly to the position where the special tool insertion guideline aligns with the timing chain case assembly top surface (B in the illustration), and the spread timing chain tension side guide can be hold (C in the illustration).

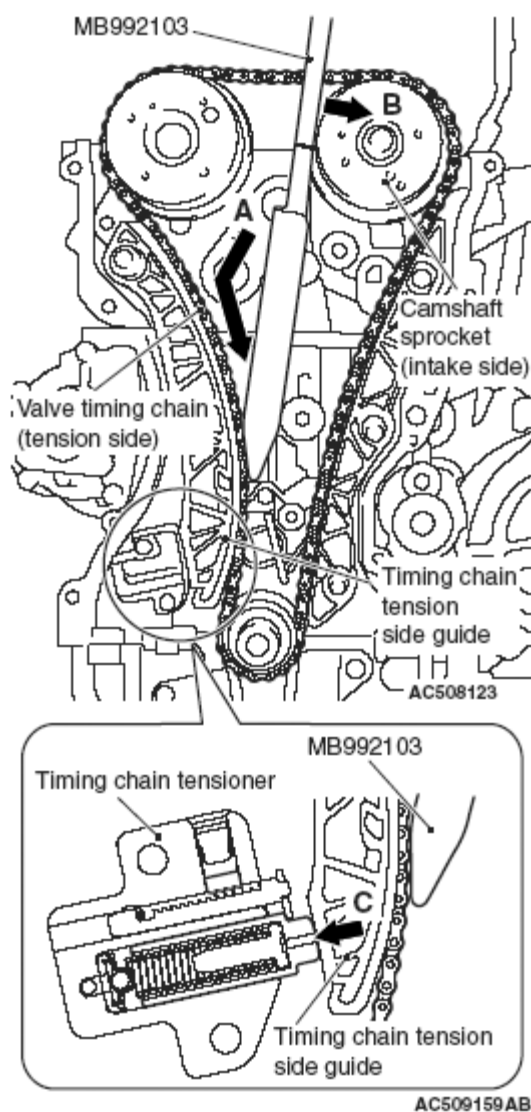


Fig. 31: Inserting Special Tool MB992103

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. With the special tool inserted up to the insertion guide line, press the special tool against the intake side camshaft sprocket and spread and hold the timing chain tension side guide.

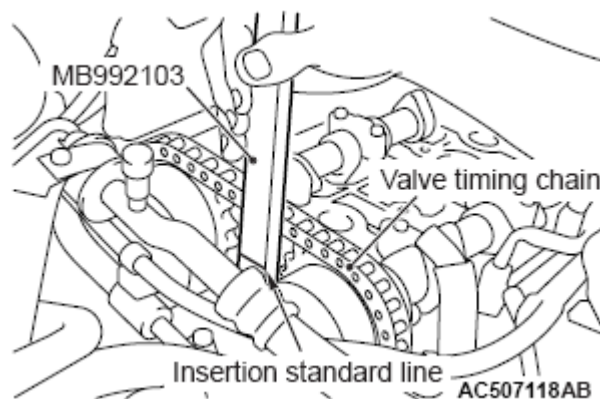


Fig. 32: Inserting Special Tool

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Remove the flat-tipped precision screwdriver unlocking the timing chain tensioner.

CAUTION: The valve timing chain may be bitten by other parts. After sagging the valve timing chain, never rotate the crankshaft.

5. With the timing chain tension side guide spread, hook the special tool over the hexagon part of the camshaft on the exhaust side, and turn the camshaft clockwise to apply slack to the valve timing chain between the camshaft sprockets.

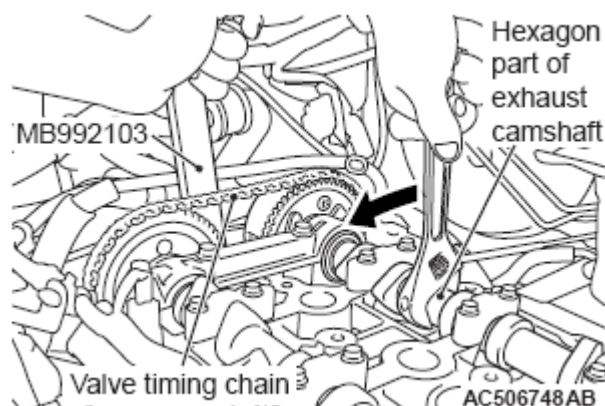


Fig. 33: Turning Camshaft Clockwise

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< D >> CAMSHAFT BEARING FRONT CAP ASSEMBLY REMOVAL

CAUTION: Be careful not to drop the camshaft bearing.

Loosen the camshaft bearing front cap mounting bolts in the order of number shown in the illustration, and remove the camshaft bearing front cap assembly.

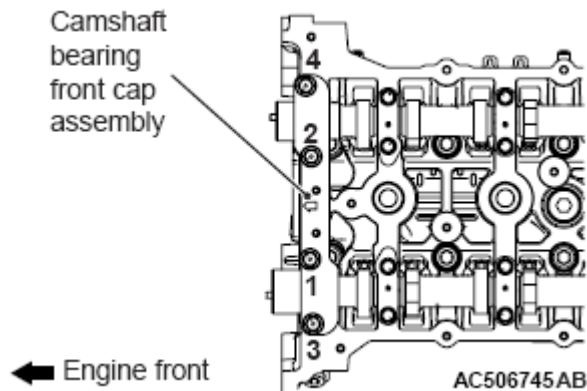


Fig. 34: Identifying Loosening Sequence Of Camshaft Bearing Front Cap Mounting Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< E >> CAMSHAFT BEARING OIL FEEDING CAP/CAMSHAFT BEARING CAP/CAMSHAFT BEARING THRUST CAP REMOVAL

CAUTION: When the camshaft bearing cap mounting bolts are loosened at once, the mounting bolts jump out by the spring force and the threads are damaged. Always loosen the mounting bolts in four or five steps.

Loosen the camshaft bearing cap mounting bolts in the order of number shown in the illustration in four or five steps, and remove the camshaft bearing caps.

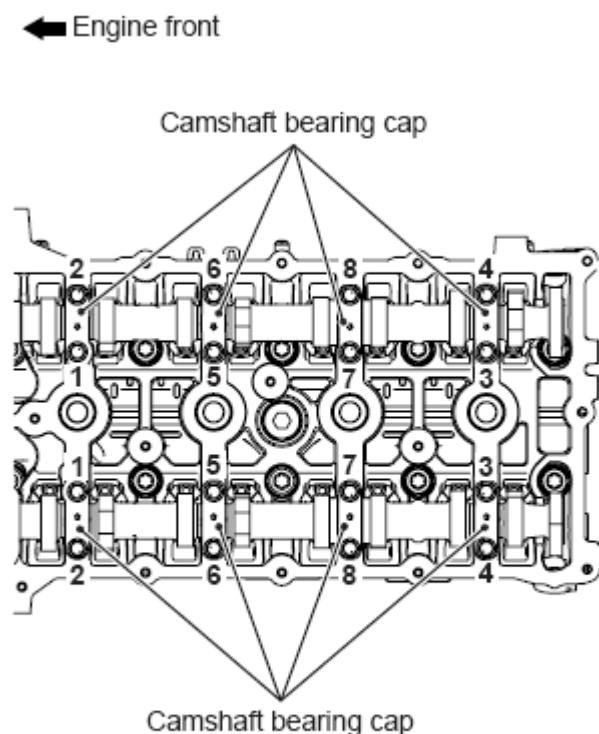


Fig. 35: Identifying Loosening Sequence Of Camshaft Bearing Cap Mounting Bolts
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< F >> CAMSHAFT AND CAMSHAFT SPROCKET ASSEMBLY (EXHAUST SIDE) REMOVAL

1. Raise slightly the transaxle side of the camshaft and camshaft sprocket assembly (exhaust side) by using the slack of the valve timing chain, and remove from the cam bearing.

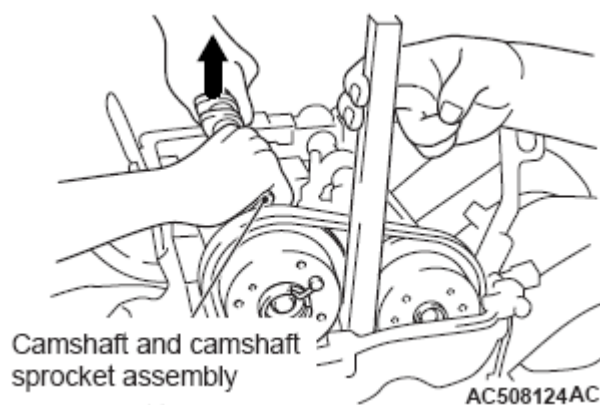


Fig. 36: Removing Camshaft And Camshaft Sprocket Assembly
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the valve timing chain from the camshaft and camshaft sprocket assembly (exhaust side) toward

the timing chain case assembly, and remove the camshaft and camshaft sprocket assembly (exhaust side) toward the transaxle.

3. Remove special tool MB992103 inserted into the timing chain case assembly inside.

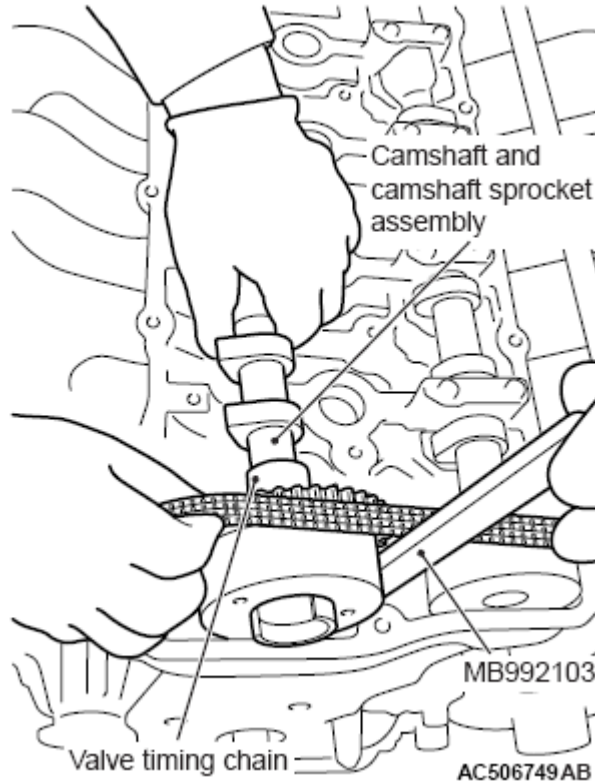


Fig. 37: Removing Valve Timing Chain

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: The valve timing chain may be bitten by other parts. After removing the camshaft and camshaft sprocket assembly, never rotate the crankshaft.

4. After removing the camshaft and camshaft sprocket assembly (exhaust side), hang up the valve timing chain with a rope to prevent the valve timing chain from falling into the timing chain case assembly.

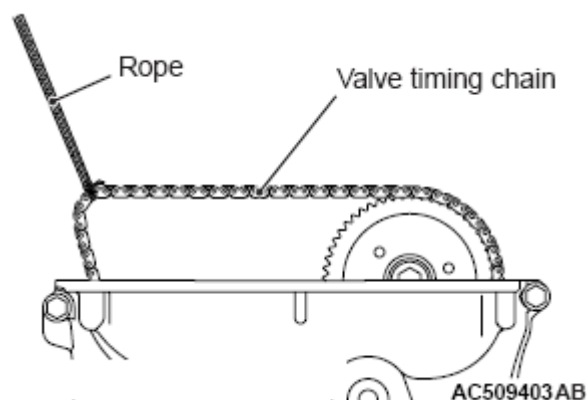


Fig. 38: Hanging Up Valve Timing Chain With Rope
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< G >> CAMSHAFT SPROCKET/CAMSHAFT REMOVAL

Hold the hexagon part of the camshaft with a monkey wrench. Loosen the camshaft sprocket mounting bolt and remove the camshaft sprocket from the camshaft.

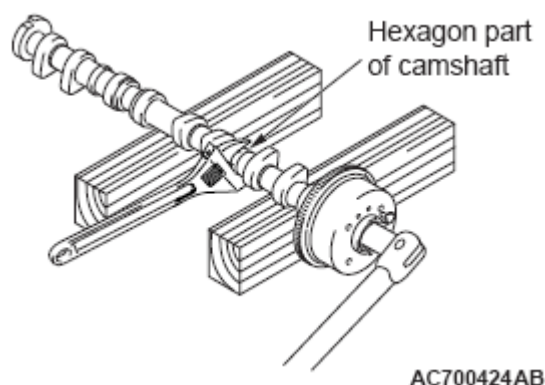


Fig. 39: Holding Hexagon Part Of Camshaft
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< H >> OIL FEEDER CONTROL VALVE REMOVAL

CAUTION: After removal of the oil feeder control valve, be careful to prevent dust from getting into the oil passage in the cylinder head.

INSTALLATION SERVICE POINTS

>> A << O-RING/OIL FEEDER CONTROL VALVE INSTALLATION

CAUTION: When installing the oil feeder control valve, be careful to avoid damage to the O-ring.

Apply engine oil to the O-ring of the oil feeder control valve and install the oil feeder control valve to the cylinder head.

>> B << CAMSHAFT/CAMSHAFT SPROCKET INSTALLATION

1. Use a monkey wrench to secure the hexagon part of the camshaft in the same manner as removal.

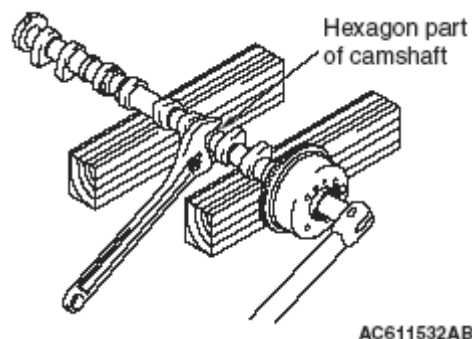


Fig. 40: Securing Hexagon Part Of Camshaft

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Apply an adequate and minimum amount of engine oil to the positions shown of the camshaft and the camshaft sprocket.
3. Install the camshaft sprocket to the camshaft.
4. Apply an adequate and minimum amount of engine oil to the camshaft sprocket bolt.
5. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 59 ± 5 N.m (44 ± 3 ft-lb)

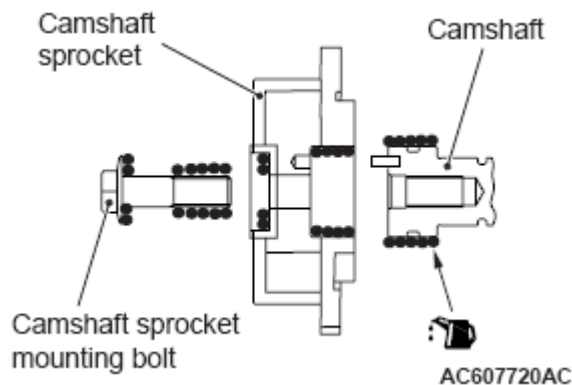


Fig. 41: Installing Camshaft Sprocket To Camshaft

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << CAMSHAFT AND CAMSHAFT SPROCKET ASSEMBLY (INTAKE SIDE) INSTALLATION

1. Align the intake side paint mark of the valve timing chain which was put at removal with the paint mark of the intake side camshaft sprocket, and install the camshaft sprocket to the valve timing chain.

2. Install the camshaft and camshaft sprocket assembly (intake side) to the cylinder head.

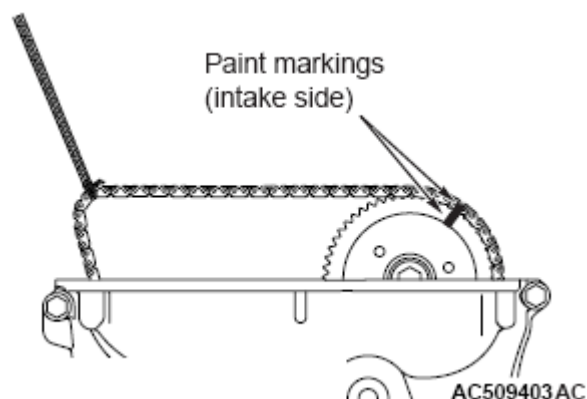


Fig. 42: Installing Camshaft And Camshaft Sprocket Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> D << CAMSHAFT BEARING THRUST CAP/CAMSHAFT BEARING CAP/CAMSHAFT BEARING OIL FEEDING CAP INSTALLATION

1. Install the camshaft bearing caps to the cylinder head.

NOTE: Because the camshaft bearing thrust cap and camshaft bearing cap are the same in shape, check the bearing cap number and additionally its symbol to identify the intake and exhaust sides for correct installation.

2. Tighten each camshaft bearing cap mounting bolts to the specified torque in the order of number shown in the illustration in two or three steps.

Tightening torque: 12 ± 1 N.m (106 ± 8 in-lb)

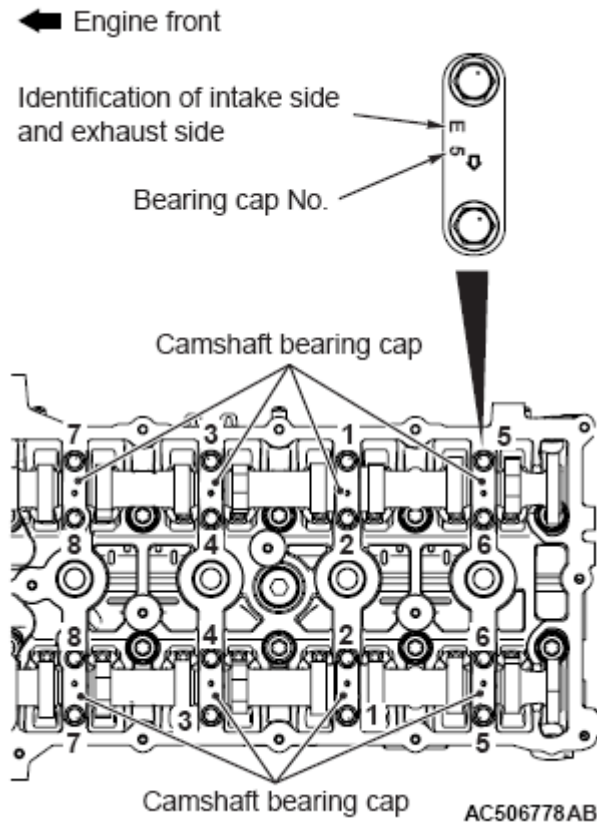


Fig. 43: Identifying Tightening Sequence Of Camshaft Bearing Cap Bolts
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> E << CAMSHAFT BEARING/CAMSHAFT AND CAMSHAFT SPROCKET ASSEMBLY (EXHAUST SIDE)
 INSTALLATION

CAUTION:

- Be careful not to drop the camshaft bearing.
- When installing the camshaft and camshaft sprocket assembly (exhaust side), be careful not to let the camshaft bearing which is installed to the front cam bearing deviate from its position.

1. When replacing the camshaft bearing, select a camshaft bearing in relevant size according to the camshaft bearing front cap assembly identification mark in the table below. The camshaft bearing identification mark is stamped at the position shown in the illustration.

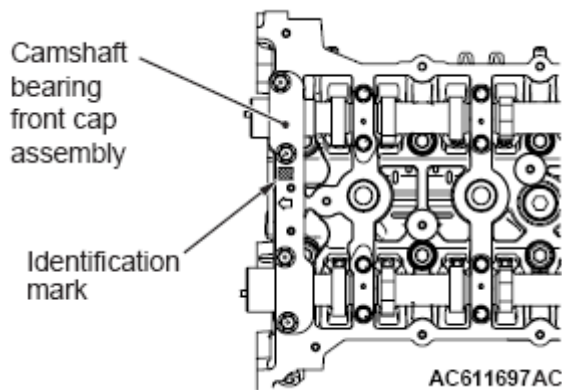


Fig. 44: Locating Camshaft Bearing Identification Mark
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAMSHAFT BEARING SELECTION

Camshaft bearing front cap assembly		Camshaft bearing identification mark
Identification mark	Journal diameter mm (in)	
1	40.000 - 40.008 (1.5748 - 1.5751)	1
2	40.008 - 40.016 (1.5751 - 1.5754)	2
3	40.016 - 40.024 (1.5754 - 1.5757)	3

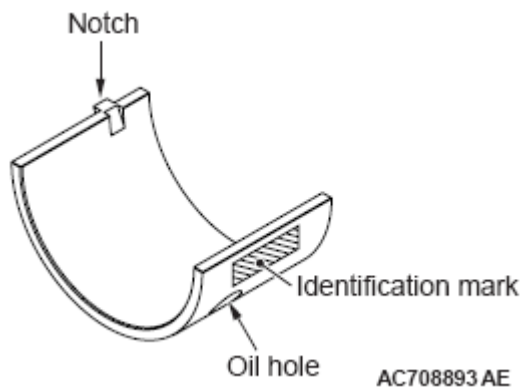


Fig. 45: Locating Oil Hole, Notch, And Identification Mark
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

- In the same manner as removal, insert the precision flat-tipped screwdriver through the service hole of the timing chain case assembly, press up the ratchet of timing chain tensioner to unlock, and hold the unlocked timing chain tensioner.

NOTE: Lightly press down the tail end of the precision flat-tipped screwdriver to press up the tip of the precision flat-tipped screwdriver inserted to the timing chain tensioner to unlock.

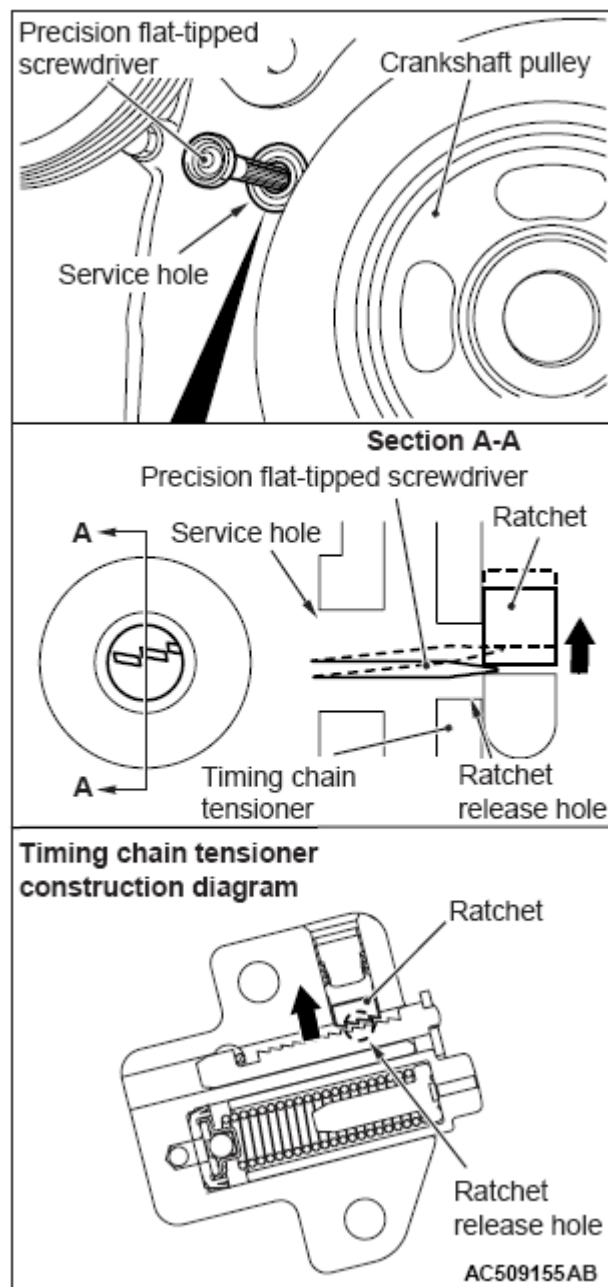


Fig. 46: Unlocking Timing Chain Tensioner

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION:

- When inserting the special tool into the timing chain case assembly inside, pay attention to the position of the valve timing chain to avoid damage to the valve timing chain and timing chain tension side guide. Do not insert the special tool beyond its insertion guideline.
- If unlocking the timing chain tensioner is insufficient, the special tool cannot be inserted to the insertion guideline. Do not

insert the special tool forcibly, follow Step 2 again to unlock the timing chain tensioner and insert the special tool.

3. With the timing chain tensioner unlocked, insert special tool MB992103 from the timing chain case assembly inside along the tension side of the valve timing chain until the insertion guide line aligns with the upper surface of the timing chain case assembly (A in the illustration).

NOTE: With the timing chain tensioner unlocked, insert the special tool along the tension side of the valve timing chain, according to the special tool top shape. The special tool can be inserted smoothly to the position where the special tool insertion guideline aligns with the timing chain case assembly top surface, and the spread timing chain tension side guide can be hold.

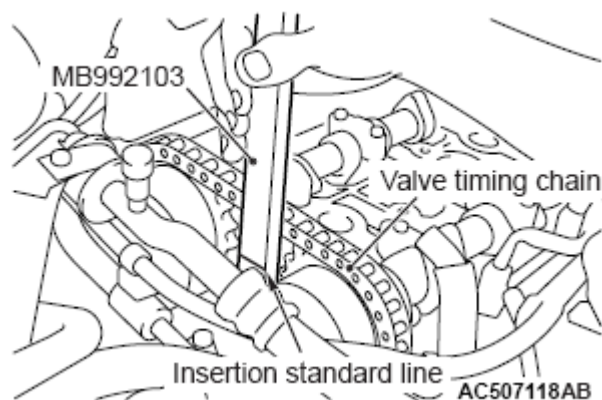


Fig. 47: Inserting Special Tool

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. With the special tool inserted up to the insertion guide line, press the special tool against the intake side camshaft sprocket (B in the illustration) and spread and hold the timing chain tension side guide (C in the illustration).
5. Remove the flat-tipped precision screwdriver unlocking the timing chain tensioner.
6. Pull up the camshaft and camshaft sprocket assembly (exhaust side) mounting area of the valve timing chain (D in the illustration) to provide allowance for easy installation of the camshaft and camshaft sprocket assembly (exhaust side) to the valve timing chain.

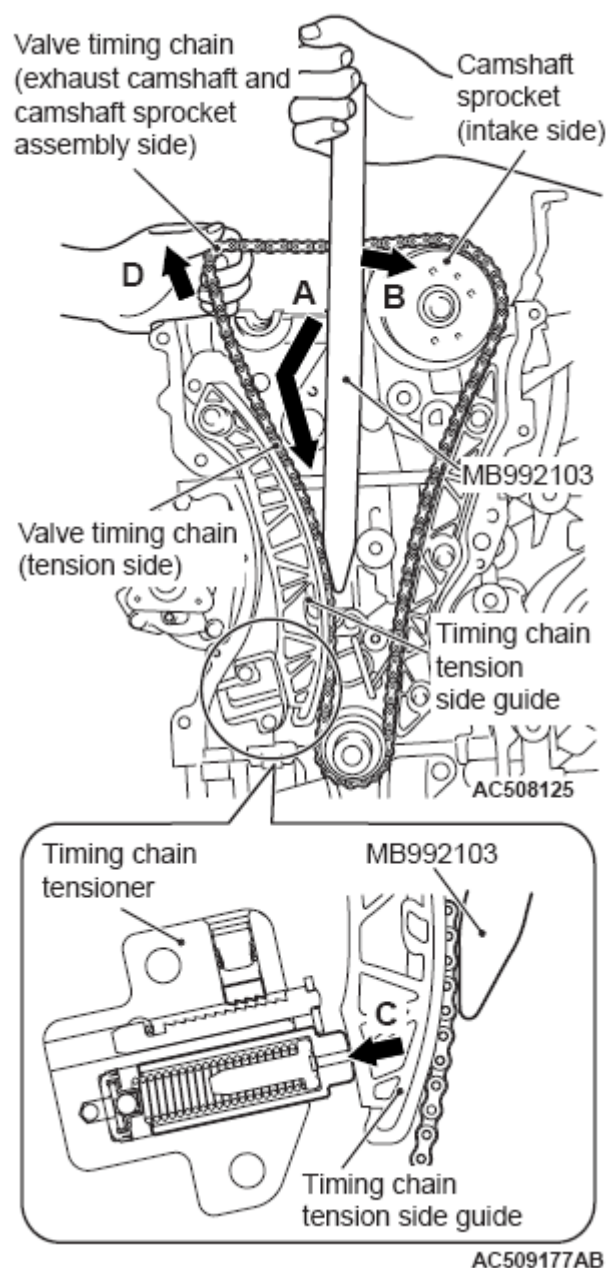


Fig. 48: Preparing For Camshaft And Camshaft Sprocket Installation
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: When installing the camshaft and camshaft sprocket assembly (exhaust side), be careful not to let the camshaft bearing which is installed to the front cam bearing deviate from its position.

7. Align the exhaust side paint mark of the valve timing chain which was put at removal with the paint mark of the exhaust side camshaft sprocket, and install the valve timing chain to the camshaft sprocket.
8. Install the camshaft and camshaft sprocket assembly (exhaust side) to the cylinder head.
9. Remove the special tool inserted into the timing chain case assembly inside.

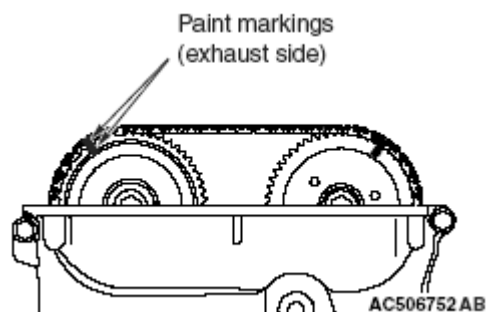


Fig. 49: Aligning Exhaust Side Paint Mark Of Timing Chain
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> F << CAMSHAFT BEARING FRONT CAP ASSEMBLY INSTALLATION

CAUTION: When the mounting bolts are tightened with the camshaft bearing front cap tilted, the camshaft bearing front cap is damaged. Install the camshaft bearing front cap properly to the cylinder head and camshaft.

1. Install the camshaft bearing front cap to the cylinder head, and temporarily tighten the camshaft bearing front cap mounting bolts to the specified torque in the order shown in the illustration (1).

Tightening torque: 17 ± 3 N.m (13 ± 2 ft-lb)

2. Tighten again the camshaft bearing front cap mounting bolts to the specified torque again in the order shown in the illustration (2).

Tightening torque: 30 ± 2 N.m (22 ± 1 ft-lb)

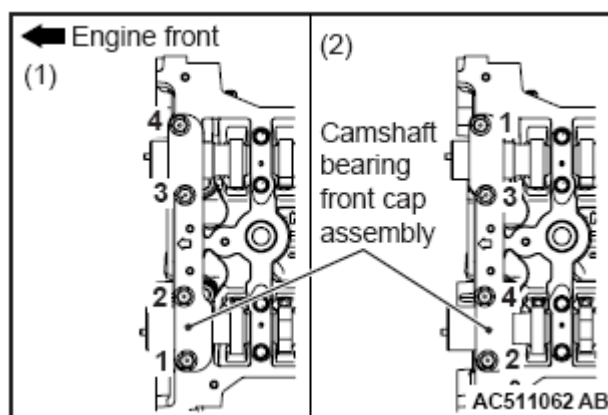


Fig. 50: Tightening Camshaft Bearing Front Cap Mounting Bolts
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. After the camshaft bearing front cap installation, check that the paint markings of the camshaft sprocket and the timing chain and the timing mark of the crankshaft pulley and the "T" mark position of ignition timing indicator are aligned respectively.

>> G << **ROCKER COVER ASSEMBLY INSTALLATION**

1. Remove the sealant from the mating surfaces of rocker cover assembly, cylinder head, and timing chain case assembly, and degrease the surface where the sealant is applied.

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

2. To the joints between the cylinder head and timing chain case assembly, apply the sealant with a diameter of 4 mm (0.16 inch) as shown in the illustration. Then, install the rocker cover assembly to the cylinder head.

Specified sealant: ThreeBond 1227D or equivalent

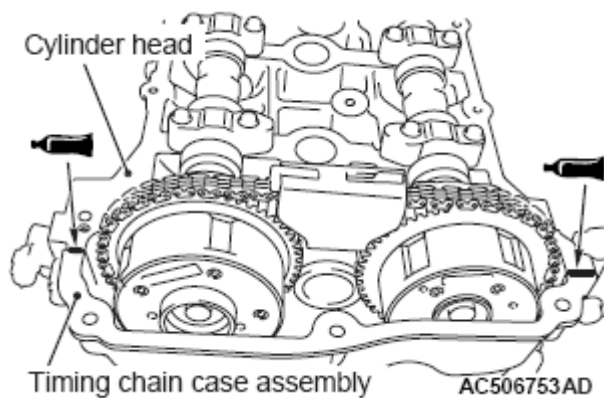


Fig. 51: Identifying Sealant Application Areas
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: Install the rocker cover assembly immediately after applying sealant.

3. Tighten the rocker cover assembly mounting bolts to the specified torque in the order of number shown in the illustration.

Tightening torque: 3.0 ± 1.0 N.m (27 ± 8 in-lb)

4. Tighten again the rocker cover assembly mounting bolts to the specified torque in the order of number shown in the illustration.

Tightening torque: 5.5 ± 0.5 N.m (49 ± 4 in-lb)

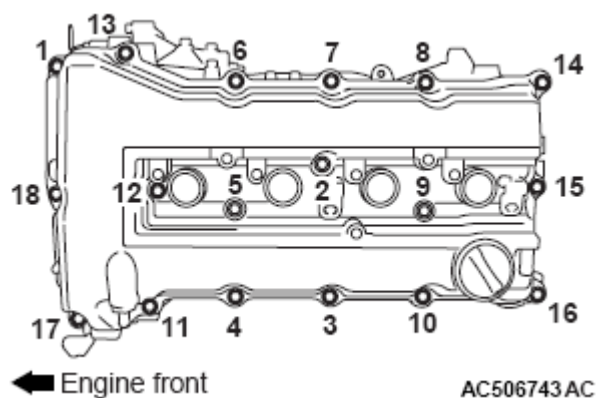


Fig. 52: Identifying Tightening Sequence Of Rocker Cover Assembly Mounting Bolts
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

VALVE STEM SEAL

REMOVAL AND INSTALLATION

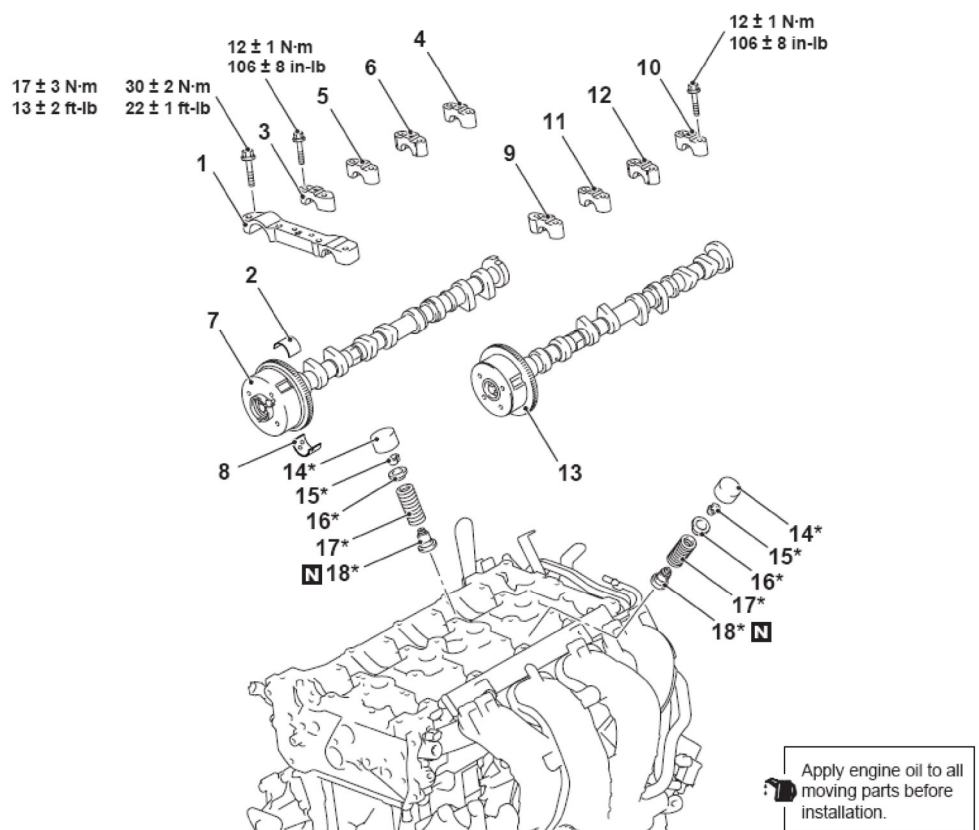
CAUTION: * Remove and assemble the marked parts in each cylinder unit.

Pre-removal Operation

- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal
- Engine Oil Draining
- Rocker Cover Assembly Removal
- Engine Oil Pan Removal
- Valve Timing Chain Removal

Post-installation Operation

- Valve Timing Chain Installation
- Engine Oil Pan Installation
- Valve Clearance Check
- Rocker Cover Assembly Installation
- Engine Oil Refilling
- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation



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Removal steps

- <<A>> >>F<< 1. Camshaft bearing front cap assembly
- >>E<< 2. Camshaft bearing
- <> >>D<< 3. Camshaft bearing oil feeding cap (exhaust side)
- <> >>D<< 4. Camshaft bearing cap (exhaust side)
- <> >>D<< 5. Camshaft bearing cap (exhaust side)
- <> >>D<< 6. Camshaft bearing thrust cap (exhaust side)
- >>E<< 7. Camshaft and camshaft sprocket assembly (exhaust side)

Removal steps (Continued)

- >>E<< 8. Camshaft bearing
- <> >>D<< 9. Camshaft bearing oil feeding cap (intake side)
- <> >>D<< 10. Camshaft bearing cap (intake side)
- <> >>D<< 11. Camshaft bearing cap (intake side)
- <> >>D<< 12. Camshaft bearing thrust cap (intake side)
13. Camshaft and camshaft sprocket assembly (intake side)
- Spark plug
- <<C>> >>C<< 14. Valve tappet
- <<D>> >>B<< 15. Valve spring retainer lock
16. Valve spring retainer
17. Valve spring
- <<E>> >>A<< 18. Valve stem seal

Fig. 53: Identifying Valve Stem Seal Remove/Install Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991928: Engine Hanger
- MB991895: Engine Hanger
- MD998772: Valve Spring Compressor
- MB992089: Retainer Holder C
- MB992090: Retainer Holder Attachment
- MB992085: Valve Stem Seal Pliers
- MD998737: Valve Stem Seal Installer

REMOVAL SERVICE POINTS**<< A >> CAMSHAFT BEARING FRONT CAP ASSEMBLY REMOVAL**

1. Temporarily install the engine oil pan which was removed at the valve timing chain removal (Refer to **REMOVAL AND INSTALLATION**).

CAUTION: When supporting the engine and transaxle assembly with a garage jack, be careful not to deform the engine oil pan.

2. Place a garage jack against the engine oil pan with a piece of wood in between to support the engine and transaxle assembly.
3. Remove special tool MB991928 or MB991895 which was installed for supporting the engine and transaxle assembly when the valve timing chain was removed.

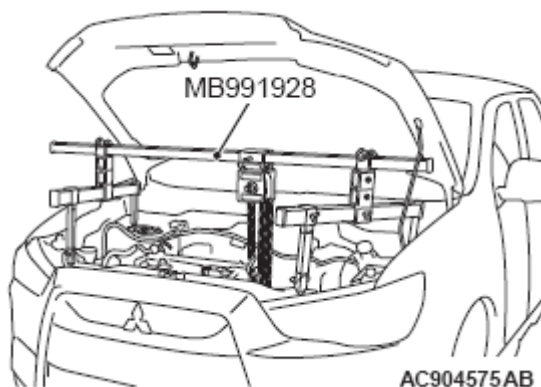


Fig. 54: Identifying Special Tool MB991928

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

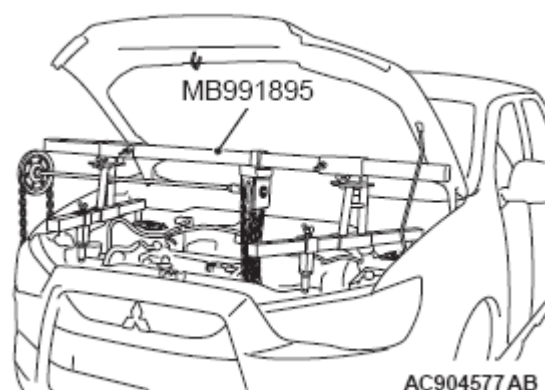


Fig. 55: Identifying Special Tool MB991895

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Be careful not to drop the camshaft bearing.

4. Loosen the camshaft bearing front cap mounting bolts in the order of number shown in the illustration, and remove the camshaft bearing front cap assembly.

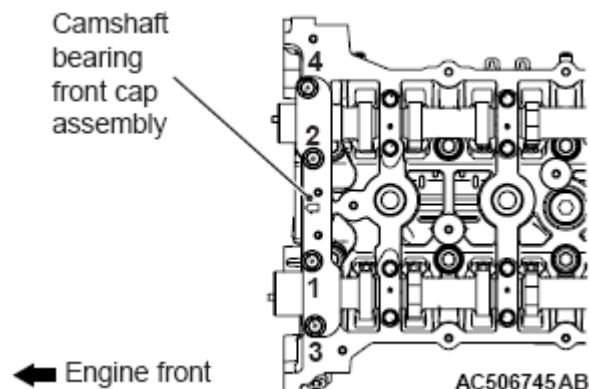


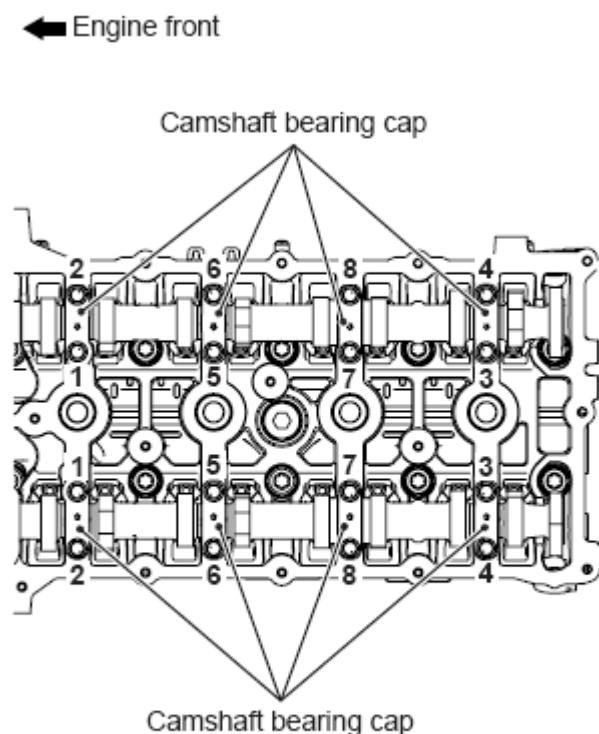
Fig. 56: Identifying Loosening Sequence Of Camshaft Bearing Front Cap Mounting Bolts

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> CAMSHAFT BEARING OIL FEEDING CAP/CAMSHAFT BEARING CAP/CAMSHAFT BEARING THRUST CAP REMOVAL

CAUTION: When the camshaft bearing cap mounting bolts are loosened at once, the mounting bolts jump out by the spring force and the threads are damaged. Always loosen the mounting bolts in four or five steps.

Loosen the camshaft bearing cap mounting bolts in the order of number shown in the illustration in four or five steps, and remove the camshaft bearing caps.



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Fig. 57: Identifying Loosening Sequence Of Camshaft Bearing Cap Mounting Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< C >> VALVE TAPPET REMOVAL

CAUTION:

- Do not use pliers or other tools to remove the valve tappets. Always remove them by hands.
- When reusing the removed valve tappet, it has to be installed in the same position as before. Be sure to put a tab that shows the original installation position on the valve tappet when storing it.

Remove all of the valve tappets by hands.

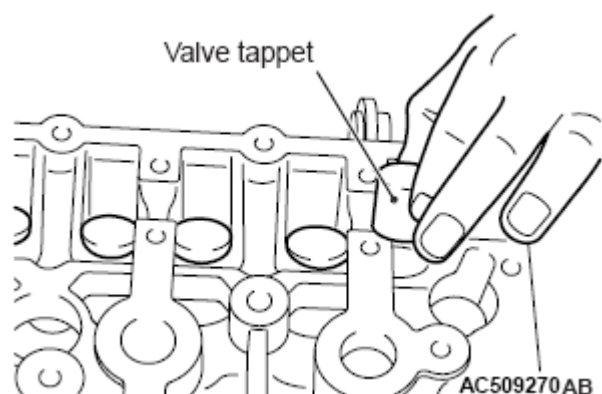


Fig. 58: Removing Valve Tappet

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< D >> VALVE SPRING RETAINER LOCK REMOVAL

1. Screw in special tool MB992090 to special tool MD998772 and assemble special tool MB992089.

CAUTION: When removing the valve spring retainer lock, leave the piston of the 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.

2. Install special tool MD998772 (with special tools MB992090 and MB992089 attached) to the cylinder head and compress the valve spring. Then, remove the valve spring retainer lock.

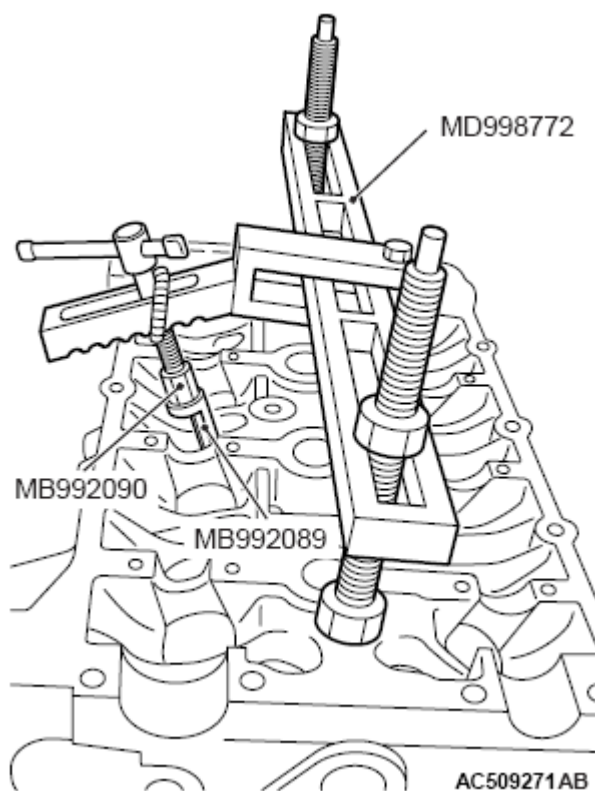


Fig. 59: Compressing Valve Spring

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< E >> VALVE STEM SEAL REMOVAL

Use special tool MB992085 to grip the base of the stem seal (where the outside diameter is larger) securely, and remove it by twisting it to the left and right.

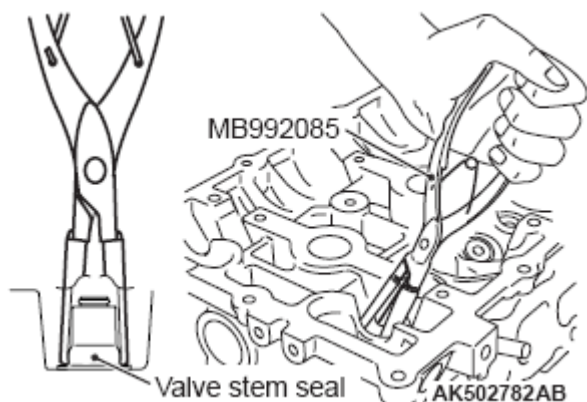


Fig. 60: Removing Valve Stem Seal

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

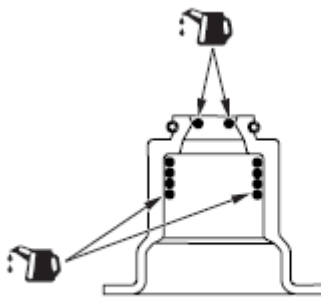
INSTALLATION SERVICE POINTS

>> A << VALVE STEM SEAL INSTALLATION

CAUTION:

- Valve stem seals cannot be reused.
- Do not damage the wall of the tappet hole when installing the valve stem seal.
- Special tool MD998737 must be used to install the valve stem seal. Improper installation of the valve stem seal could result in oil leaking past the valve guide.

1. Apply a small amount of engine oil to the press-fit part and lip part of the new valve stem seal.

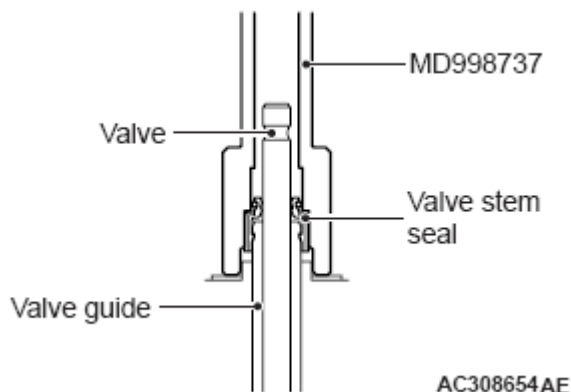


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Fig. 61: Applying Small Amount Of Engine Oil To Press-Fit Part And Lip Part Of New Valve Stem Seal

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Use special tool MD998737 to press-fit a new valve stem seal in the valve guide using the valve stem area as a guide.



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Fig. 62: Installing Valve Stem Seal

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << VALVE SPRING RETAINER LOCK INSTALLATION

In the same manner as removal, use special tool MD998772 (with special tools MB992090 and MB992089 attached) to compress the valve spring, and install the valve spring retainer lock.

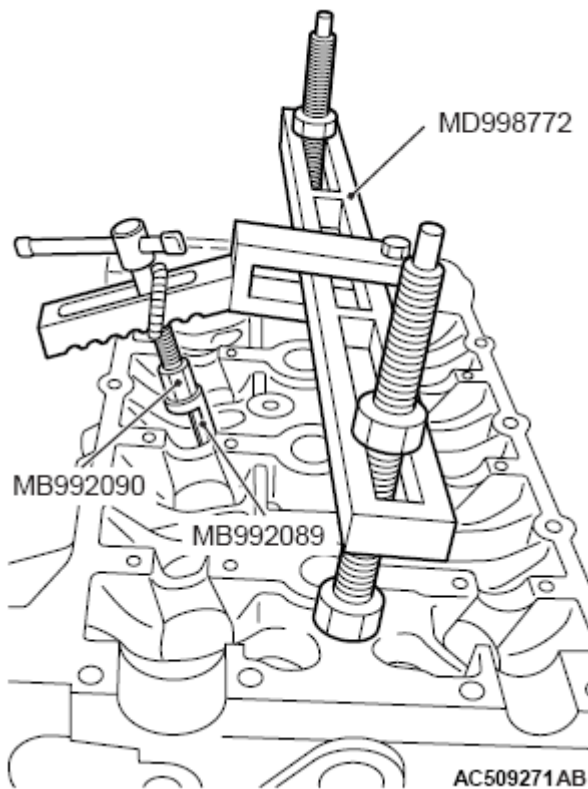


Fig. 63: Compressing Valve Spring

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << VALVE TAPPET INSTALLATION

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

CAUTION:

- Do not use pliers or other tools to install the valve tappets. Always install them by hand.
- Be sure to install the valve tappets in the same position as before.

2. Install the valve tappet to the cylinder head by hand.

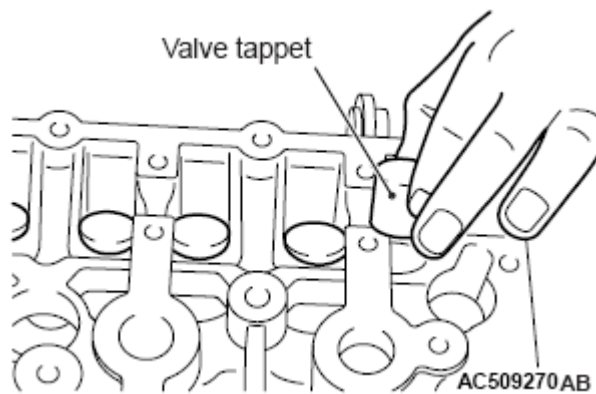


Fig. 64: Installing Valve Tappet

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> D << CAMSHAFT BEARING THRUST CAP/CAMSHAFT BEARING CAP/CAMSHAFT BEARING OIL FEEDING CAP INSTALLATION

1. Install the camshaft bearing caps to the cylinder head.

NOTE: Because the camshaft bearing thrust cap and camshaft bearing cap are the same in shape, check the cap number and additionally its symbol to identify the intake and exhaust sides for correct installation.

2. Tighten each camshaft bearing cap mounting bolts to the specified torque in the order of number shown in the illustration in two or three steps.

Tightening torque: 12 ± 1 N.m (106 ± 8 in-lb)

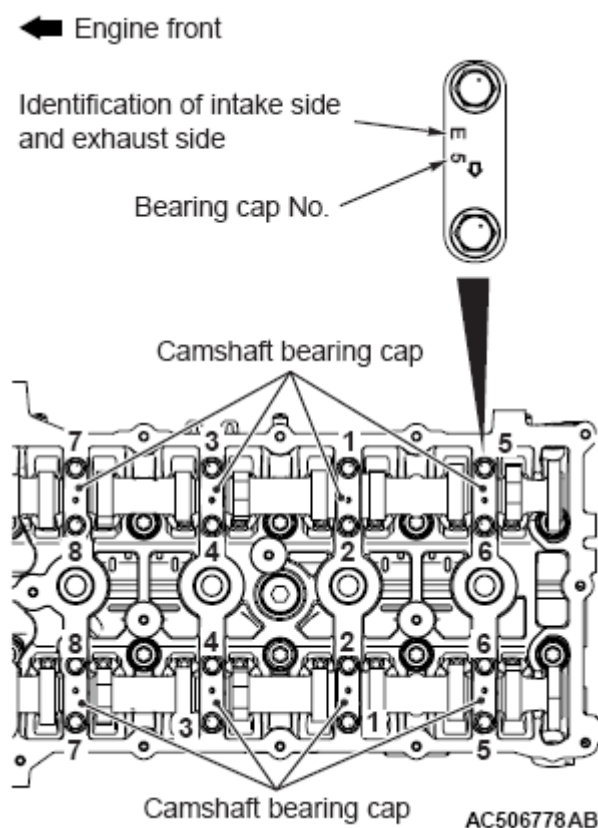


Fig. 65: Identifying Tightening Sequence Of Camshaft Bearing Cap Bolts
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> E << CAMSHAFT BEARING/CAMSHAFT AND CAMSHAFT SPROCKET ASSEMBLY (EXHAUST SIDE) INSTALLATION

CAUTION:

- Be careful not to drop the camshaft bearing.
- When installing the camshaft and camshaft sprocket assembly (exhaust side), be careful not to let the camshaft bearing which is installed to the front cam bearing deviate from its position.

When replacing the camshaft bearing, select a camshaft bearing in relevant size according to the camshaft bearing front cap assembly identification mark in the table below. The camshaft bearing identification mark is stamped at the position shown in the illustration.

CAMSHAFT BEARING SELECTION

Camshaft bearing front cap assembly		Camshaft bearing identification mark
Identification mark	Journal diameter mm (in)	
1	40.000 - 40.008 (1.5748 - 1.5751)	1
2	40.008 - 40.016 (1.5751 - 1.5754)	2
3	40.016 - 40.024 (1.5754 - 1.5757)	3

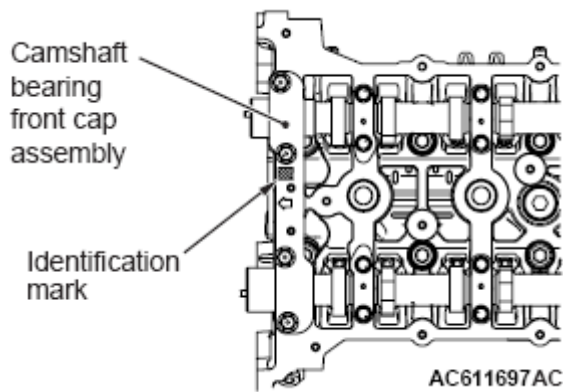


Fig. 66: Locating Camshaft Bearing Identification Mark
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

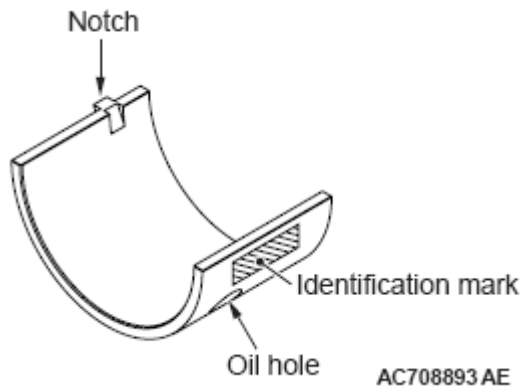


Fig. 67: Locating Oil Hole, Notch, And Identification Mark
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> F << CAMSHAFT BEARING FRONT CAP ASSEMBLY INSTALLATION

CAUTION: When the mounting bolts are tightened with the camshaft bearing front cap tilted, the camshaft bearing front cap is damaged. Install the camshaft bearing front cap properly to the cylinder head and camshaft.

1. Install the camshaft bearing front cap to the cylinder head, and temporarily tighten the camshaft bearing front cap mounting bolts to the specified torque in the order shown in the illustration **Fig. 68**.

Tightening torque: 17 ± 3 N.m (13 ± 2 ft-lb)

2. Tighten again the camshaft bearing front cap mounting bolts to the specified torque again in the order shown in the illustration **Fig. 68**.

Tightening torque: 30 ± 2 N.m (22 ± 1 ft-lb)

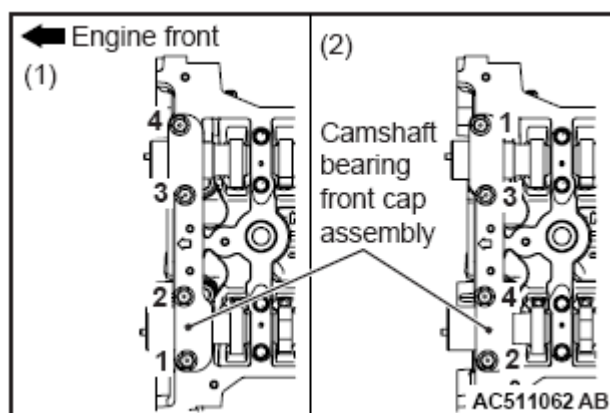


Fig. 68: Tightening Camshaft Bearing Front Cap Mounting Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Install special tool MB991928 or MB991895 which was installed for supporting the engine and transaxle assembly when the valve timing chain was removed (Refer to **REMOVAL AND INSTALLATION**).
4. Remove the garage jack which supports the engine and transaxle assembly.
5. Remove the engine oil pan installed temporarily.

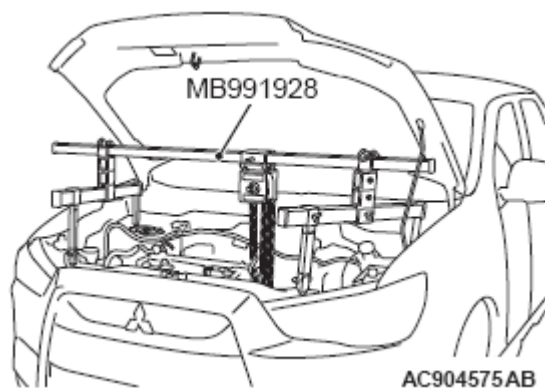


Fig. 69: Identifying Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

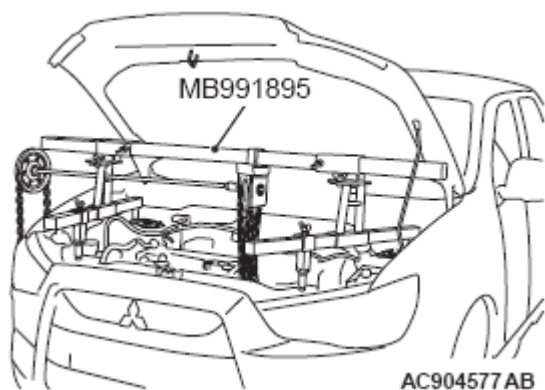


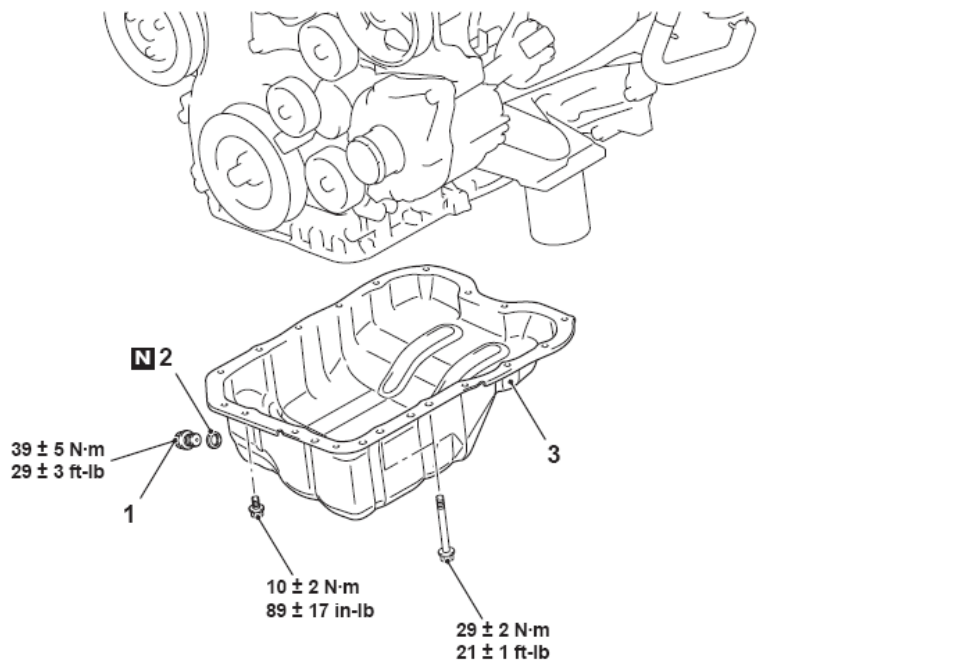
Fig. 70: Identifying Special Tool MB991895

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal Operation	Post-installation Operation
<ul style="list-style-type: none"> Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal Engine Oil Draining Drive Belt Removal 	<ul style="list-style-type: none"> Drive Belt Installation Engine Oil Refilling Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation



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- Removal steps**
- <<A>>
- A/C compressor and clutch assembly
 - A/C compressor bracket A and B
- >>B<<
- <> >>A<<
1. Engine oil pan drain plug
 2. Engine oil pan drain plug gasket
 3. Engine oil pan

Fig. 71: Identifying Oil Pan Remove/Install Components With Torque Specifications

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MD998727: Oil Pan FIPG Cutter

REMOVAL SERVICE POINTS

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

1. Remove the A/C compressor and clutch assembly together with the hose from the bracket.
2. Tie the removed A/C compressor and clutch assembly with a string at a position where they will not interfere with the removal and installation of engine oil pan.

<< B >> ENGINE OIL PAN REMOVAL

1. Remove the engine oil pan mounting bolts.

CAUTION: Do not forcibly drive in the special tool to avoid damage to the engine oil pan seal surface of cylinder block assembly.

2. Insert special tool MD998727 from the engine oil pan removal groove of the cylinder block assembly.
3. Lightly tap the special tool with a hammer to slide the engine oil pan seal surface, cut off the liquid gasket, and remove the engine oil pan.

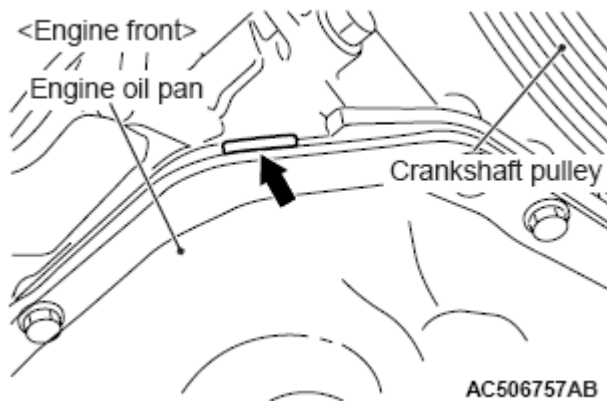


Fig. 72: Removing Engine Oil Pan (1 Of 3)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

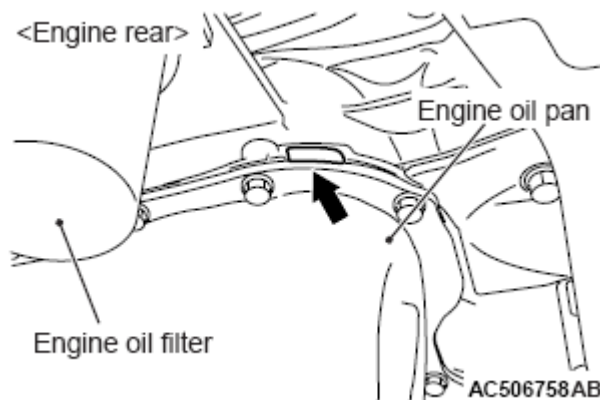


Fig. 73: Removing Engine Oil Pan (2 Of 3)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

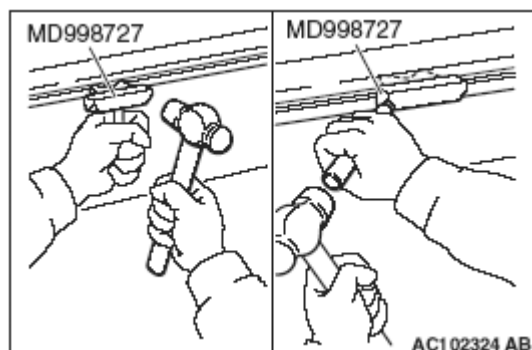


Fig. 74: Removing Engine Oil Pan (3 Of 3)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << ENGINE OIL PAN INSTALLATION

1. Remove thoroughly the sealant from the engine oil pan and cylinder block assembly with a remover.
2. Apply a bead of the sealant to the mating surface of the engine oil pan as shown in the illustration, and install the engine oil pan to the cylinder block assembly immediately.

Specified sealant: ThreeBond 1227D or equivalent

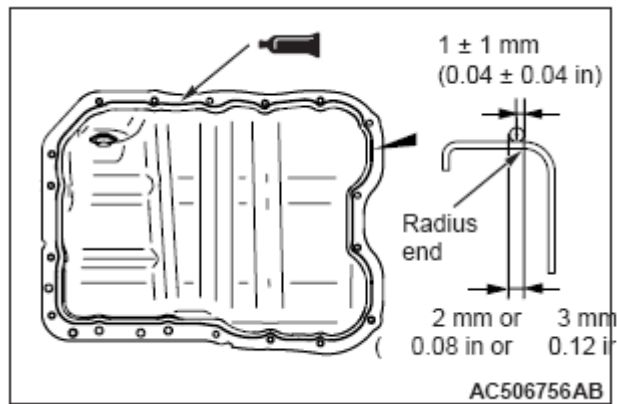
CAUTION: After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the oil or water to the sealant application area or start the engine.

3. Tighten the engine oil pan mounting bolts to the specified torque.

Tightening torque:

M6: 10 ± 2 N.m (89 ± 17 in-lb)

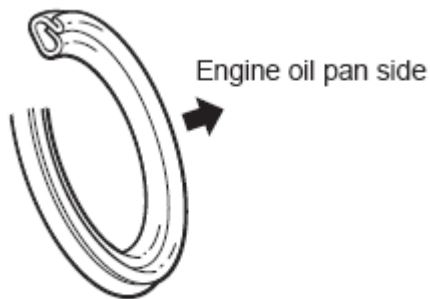
M8: 29 ± 2 N.m (21 ± 1 ft-lb)

**Fig. 75: Installing Engine Oil Pan**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Replace the engine oil pan drain plug gasket with a new one. Install the new gasket in the direction shown in the illustration.



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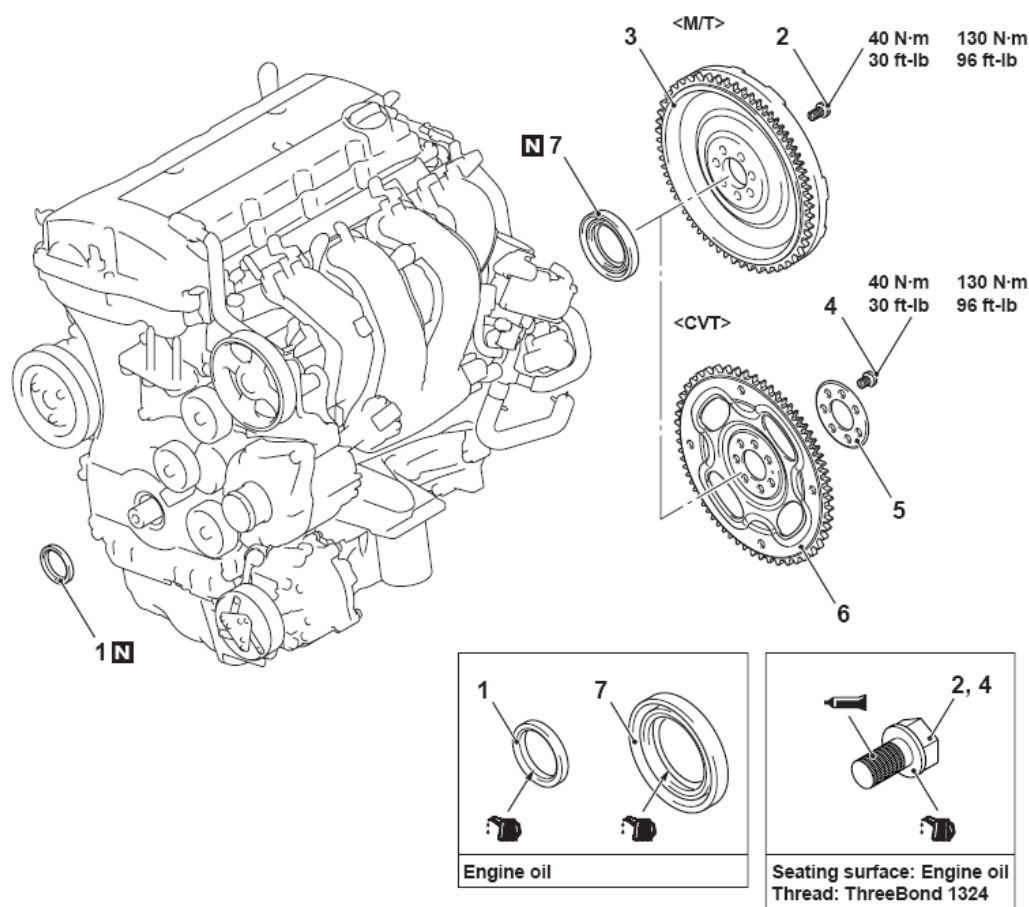
Fig. 76: Identifying Engine Oil Pan Drain Plug Gasket

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.

CRANKSHAFT OIL SEAL**REMOVAL AND INSTALLATION**



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Crankshaft front oil seal removal steps

- Crankshaft pulley

>>C<< 1. Crankshaft front oil seal

Crankshaft rear oil seal removal steps <M/T>

- Transaxle assembly
- Clutch cover and clutch disc

<<A>> >>B<< 2. Flywheel bolt

>>B<< 3.

>>A<< 7.

Crankshaft rear oil seal removal steps <M/T> (Continued)

- Flywheel assembly

- Crankshaft rear oil seal

Crankshaft rear oil seal removal steps <CVT>

- Transaxle assembly

<<A>> >>B<< 4.

>>B<< 5.

>>B<< 6.

>>A<< 7.

- Drive plate bolt
- Drive plate adapter plate
- Drive plate
- Crankshaft rear oil seal

Fig. 77: Identifying Crankshaft Oil Seal Remove/Install Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991883: Flywheel Stopper
- MD998718: Crankshaft Rear Oil Seal Installer
- MB991448: Bush Remover And Installer Base

REMOVAL SERVICE POINT

<< A >> FLYWHEEL BOLT < M/T >/DRIVE PLATE BOLT < CVT > REMOVAL

Fix the flywheel assembly using special tool MB991883, and loosen the flywheel bolts < M/T >.

Fix the drive plate using special tool MB991883, and loosen the drive plate bolts < CVT >.

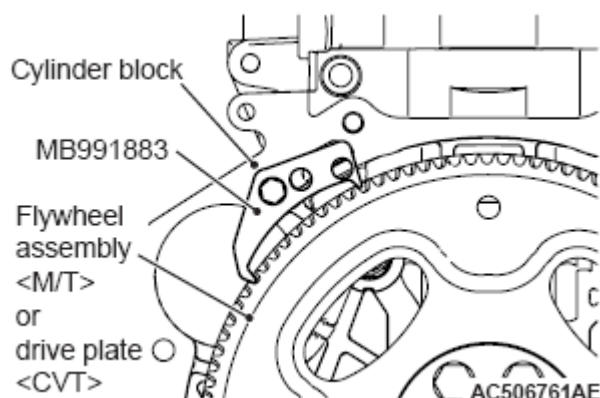


Fig. 78: Fixing Flywheel Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

1. Apply a small amount of engine oil to the entire inner diameter of the crankshaft rear oil seal lip.
2. Using special tool MD998718, press in the crankshaft rear oil seal up to the cylinder block end surface.

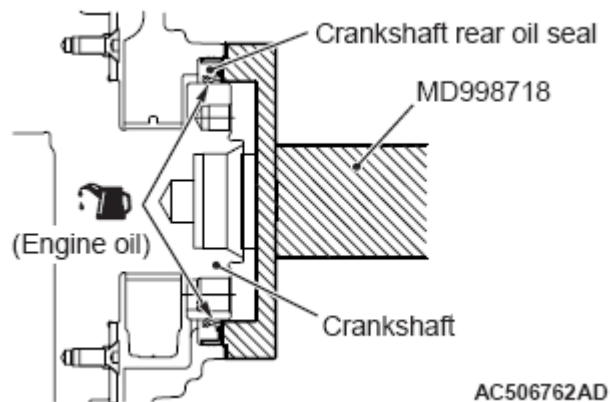


Fig. 79: Installing Crankshaft Rear Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << DRIVE PLATE < CVT >/DRIVE PLATE ADAPTER PLATE < CVT >/DRIVE PLATE BOLT < CVT >/FLYWHEEL ASSEMBLY < M/T >/FLYWHEEL BOLT < M/T > INSTALLATION

1. Remove the sealant, the engine oil, and other adhering materials from the drive plate installation face, the crankshaft screw hole and drive plate bolts. < CVT >

Remove the sealant, the engine oil, and other adhering materials from the flywheel assembly installation face, the crankshaft screw hole and flywheel bolts. < M/T >

2. Install the drive plate and drive plate adapter plate to the crankshaft. < CVT >

Install the flywheel assembly to the crankshaft. < M/T >

3. Use special tool MB991883 to secure the drive plate in the same manner as removal < CVT. >

Use special tool MB991883 to secure the flywheel assembly in the same manner as removal < M/T. >

4. Apply a small amount of engine oil to the screw holes of the crankshaft.

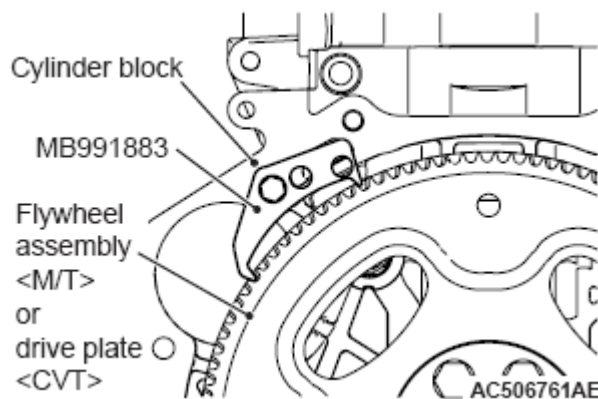


Fig. 80: Fixing Flywheel Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Apply the engine oil to the installation face of the drive plate bolts for the drive plate. < CVT >

Apply the engine oil to the installation face of the flywheel bolts for the flywheel assembly. < M/T >

6. Apply specified sealant to the drive plate bolts < CVT > or flywheel bolts < M/T > threads.

Specified sealant: ThreeBond 1324

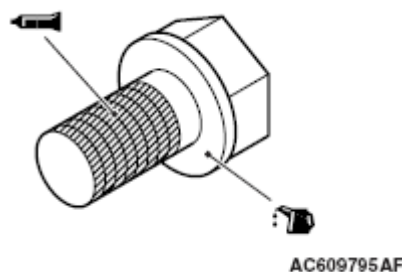


Fig. 81: Applying Engine Oil And Sealant To Drive Plate Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. Tighten the drive plate bolts < CVT > or flywheel bolts < M/T > to the specified torque in the order shown in the illustration.

Tightening torque: 40 N.m (30 ft-lb)

8. Tighten the drive plate bolts < CVT > or flywheel bolts < M/T > to the specified torque again in the order shown in the illustration.

Tightening torque: 130 N.m (96 ft-lb)

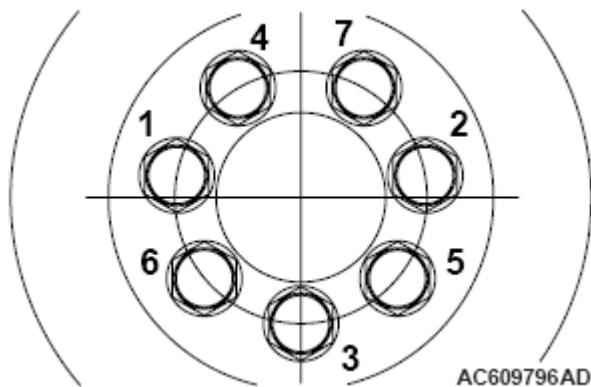


Fig. 82: Identifying Tightening Sequence Of Drive Plate Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire inner diameter of the crankshaft front oil seal lip.

CAUTION: When installing the crankshaft front oil seal, be careful to avoid damage to the crankshaft front oil seal.

2. Using special tool MB991448, press in the crankshaft front oil seal up to the chamfered surface of timing chain case.

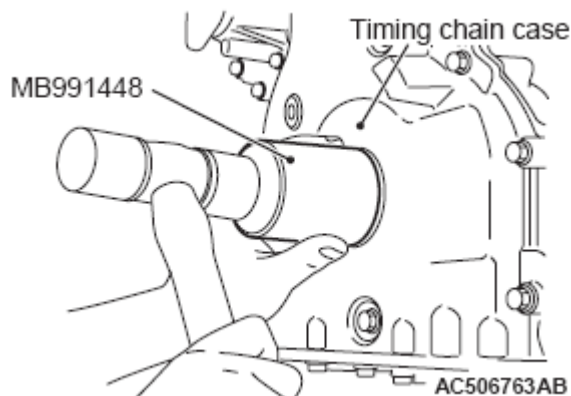


Fig. 83: Installing Crankshaft Front Oil Seal

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CYLINDER HEAD GASKET

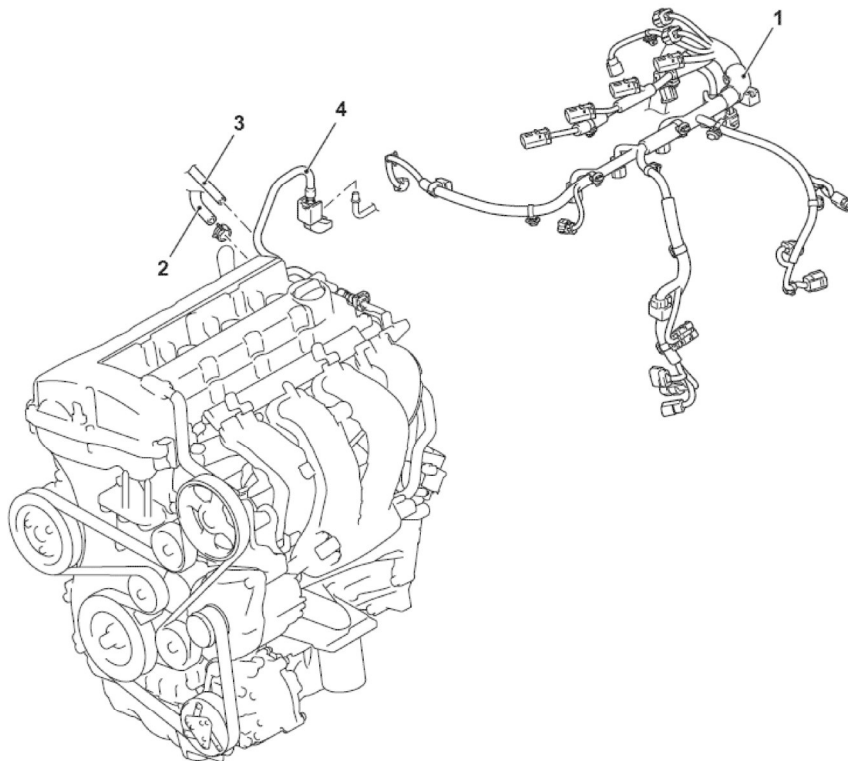
REMOVAL AND INSTALLATION

Pre-removal Operation

- Fuel Line Pressure Reduction
- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal
- Engine Coolant Draining
- Air Cleaner Assembly Removal
- Ignition Coil Removal
- Exhaust Manifold Removal
- Throttle Body Assembly Removal

Post-installation Operation

- Throttle Body Assembly Installation
- Exhaust Manifold Installation
- Ignition Coil Installation
- Air Cleaner Assembly Installation
- Engine Coolant Refilling
- Fuel Leak Check
- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation



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Removal steps

1. Control wiring harness connection
2. Brake booster vacuum hose connection
3. Canister vacuum hose connection
- Engine oil dipstick
- Intake manifold stay

<<A>>

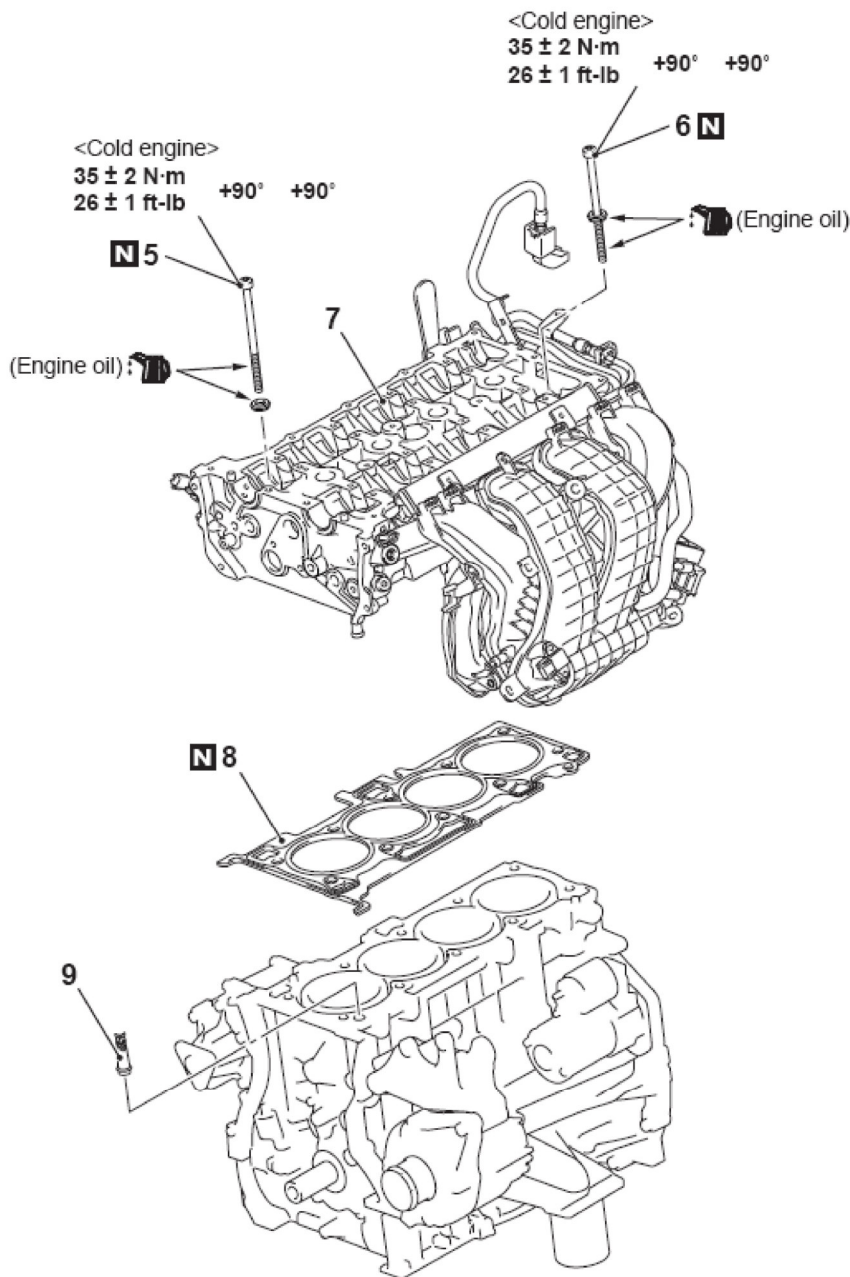
>>C<<

Removal steps (Continued)

- Heater hose connection
- Radiator upper hose connection
- Radiator lower hose connection
- Water inlet pipe
- 4. Fuel high-pressure hose connection

Fig. 84: Identifying Cylinder Head Gasket Remove/Install Components With Torque Specifications (1 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



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Removal steps

- Valve timing chain
- Camshaft and camshaft sprocket assembly

<>

<>

>>B<<

>>B<<

>>A<<

>>A<<

Removal steps (Continued)

5. Cylinder head bolt
6. Cylinder head bolt assembly
7. Cylinder head assembly
8. Cylinder head gasket
9. Oil feeder control valve filter

Fig. 85: Identifying Cylinder Head Gasket Remove/Install Components With Torque Specifications (2 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

REMOVAL SERVICE POINTS**<< A >> FUEL HIGH-PRESSURE HOSE REMOVAL**

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

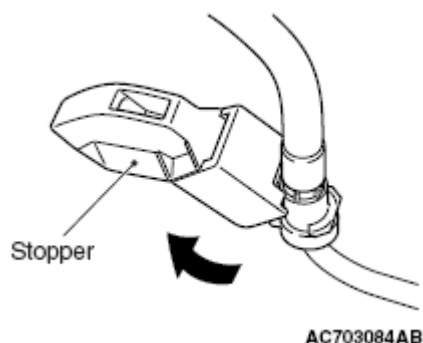


Fig. 86: Removing Stopper Of Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

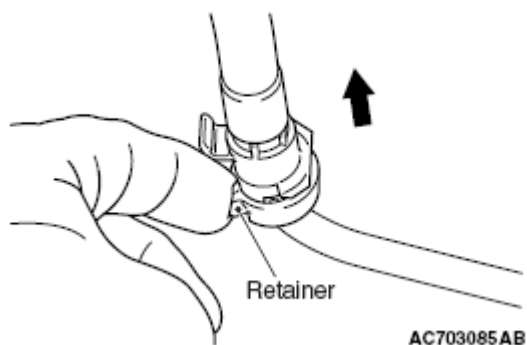


Fig. 87: Pulling Out Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> CYLINDER HEAD BOLT/CYLINDER HEAD BOLT ASSEMBLY REMOVAL

Loosen and remove the bolts in two or three steps in the order of number shown in the illustration.

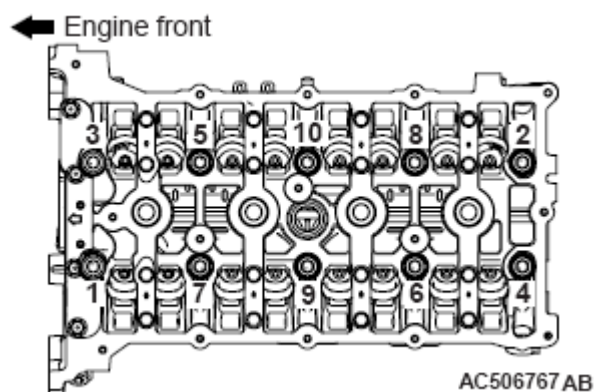


Fig. 88: Identifying Loosening Sequence Of Cylinder Head Bolts
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << CYLINDER HEAD GASKET/CYLINDER HEAD ASSEMBLY INSTALLATION

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

1. Wipe off the sealant and grease on the top surface of the cylinder block and the bottom surface of the cylinder head, and degrease the surface where the sealant is applied.

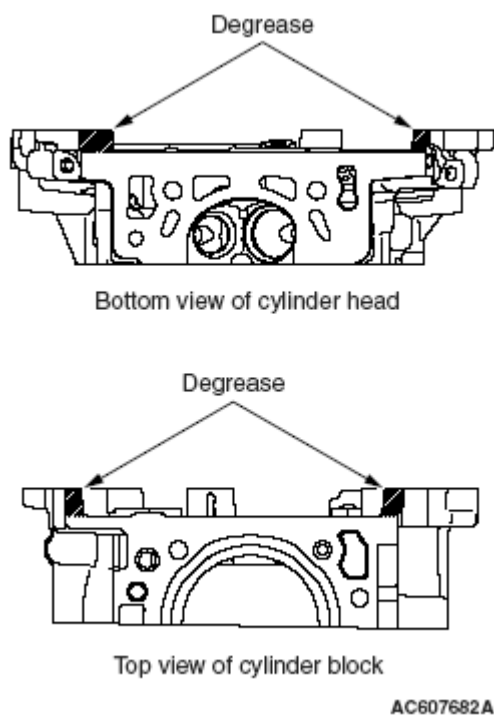


Fig. 89: Identifying Degrease Area
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Apply the sealant to the top surface of the cylinder block as shown in the illustration.

Specified sealant: ThreeBond 1217G or equivalent

NOTE: Install the cylinder head gasket immediately after applying sealant.

3. Install the cylinder head gasket to the cylinder block.

NOTE: When the cylinder head gasket is installed to the cylinder block, check that the sealant is securely applied to the bead line of the cylinder head gasket.

4. Apply the sealant to the top surface of the cylinder head gasket as shown in the illustration.

Specified sealant: ThreeBond 1217G or equivalent

NOTE: Install the cylinder head assembly immediately after applying sealant.

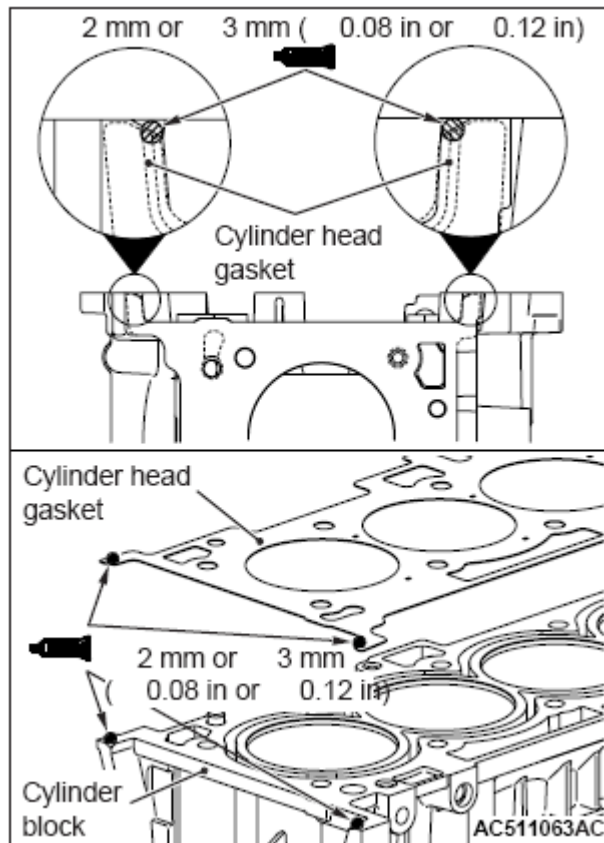


Fig. 90: Identifying Sealant Application Areas
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: After the installation, until a sufficient period of time (one hour or

more) elapses, do not apply the oil or water to the sealant application area or start the engine.

5. Install the cylinder head assembly.

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

1. Replace a cylinder head bolts with a new one.
2. For two bolts of the timing chain side, the washer can be removed from the bolt. Install the washer, with its sag facing upward, to the bolts.
3. Apply a small amount of engine oil to the cylinder head bolt threads and the washers.
4. Tighten the cylinder head bolts by the following procedure (plastic region angular tightening method).
 1. Tighten the cylinder head bolts to the specified torque in the order shown in the illustration in two or three steps.

Tightening torque: 35 ± 2 N.m (26 ± 1 ft-lb)

CAUTION:

- When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.
- When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.

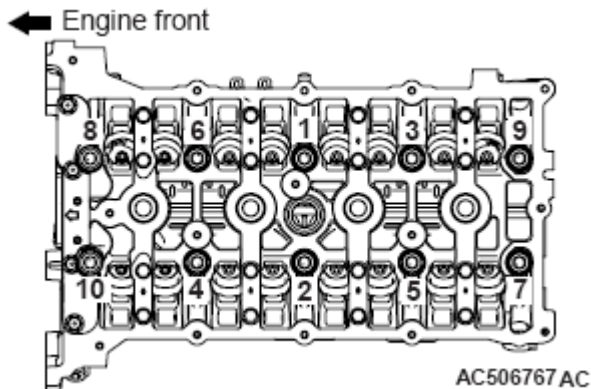


Fig. 91: Identifying Tightening Sequence Of Cylinder Head Bolts

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Apply paint marks to the head of cylinder head bolt and the cylinder head.
3. Tighten the cylinder head to 90 degrees angle in the tightening order. Additionally tighten to 90 degrees angle, and check that the paint mark on the cylinder head bolt is aligned with the paint mark on the cylinder head.

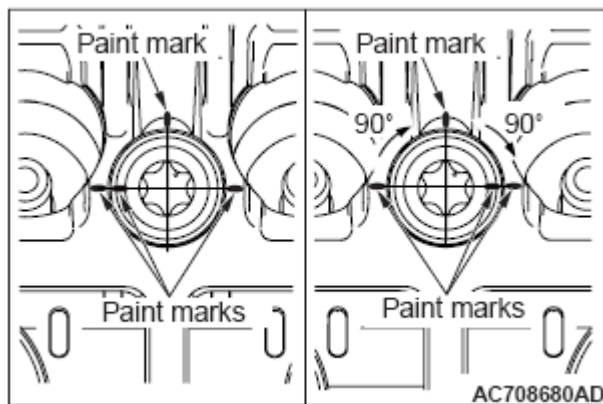


Fig. 92: Identifying Paint Marks

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << FUEL HIGH-PRESSURE HOSE INSTALLATION

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.

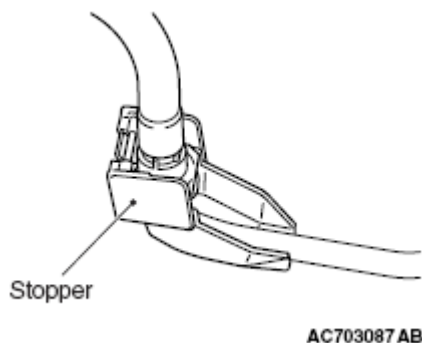


Fig. 93: Installing Fuel High-Pressure Hose

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING CHAIN

REMOVAL AND INSTALLATION

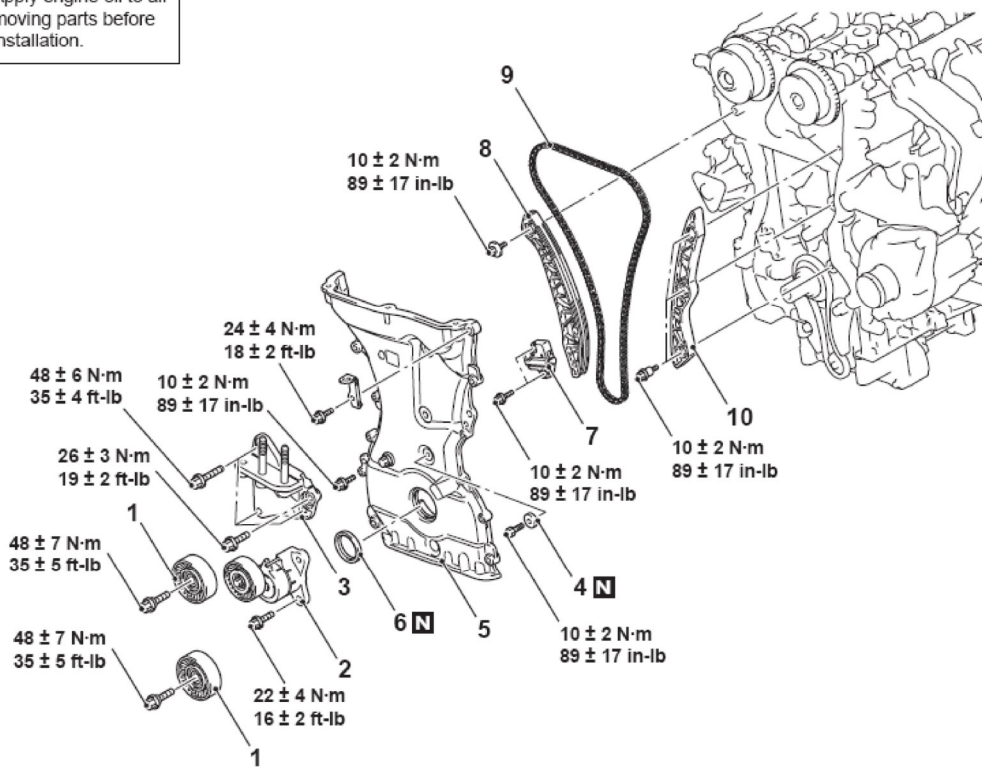
Pre-removal Operation

- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal
- Engine Oil Draining
- Rocker Cover Assembly Removal
- Engine Oil Pan Removal

Post-installation Operation

- Engine Oil Pan Installation
- Rocker Cover Assembly Installation
- Engine Oil Refilling
- Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation

Apply engine oil to all moving parts before installation.



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- <<A>>
- Crankshaft pulley
- >>D<<
- Water pump pulley
 - 1. Idler pulley
 - 2. Drive belt auto-tensioner
 - Idler pulley and bracket

- <>
- Engine mounting insulator
3. Cylinder block engine front mounting bracket
4. Gasket
- <<C>> >>C<<
- 5. Timing chain case assembly
 - 6. Crankshaft front oil seal
- <<D>> >>B<<
- 7. Timing chain tensioner
 - 8. Timing chain tension side guide
 - 9. Valve timing chain
 - 10. Timing chain loose side guide
- >>A<<

Fig. 94: Identifying Timing Chain Remove/Install Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991928: Engine Hanger
- MB991895: Engine Hanger

- MB991454: Engine Hanger Balancer

REMOVAL SERVICE POINTS**<< A >> CRANKSHAFT PULLEY REMOVAL**

When removing the crankshaft pulley, slightly loosen the water pump pulley mounting bolts before removal of the drive belt.

<< B >> ENGINE MOUNTING INSULATOR REMOVAL

1. Secure special tool MB991928 or MB991895 for holding the engine assembly (Refer to **TRANSAXLE ASSEMBLY**) < M/T > or (Refer to **TRANSAXLE ASSEMBLY**) < CVT >.

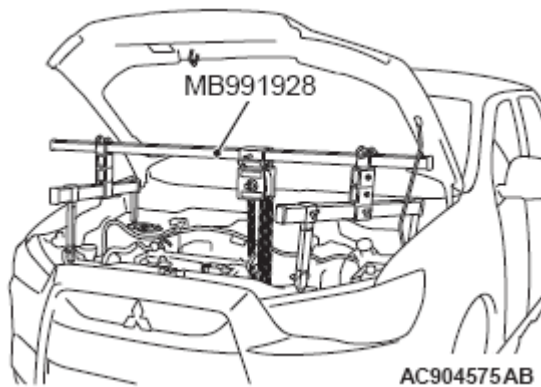


Fig. 95: Identifying Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

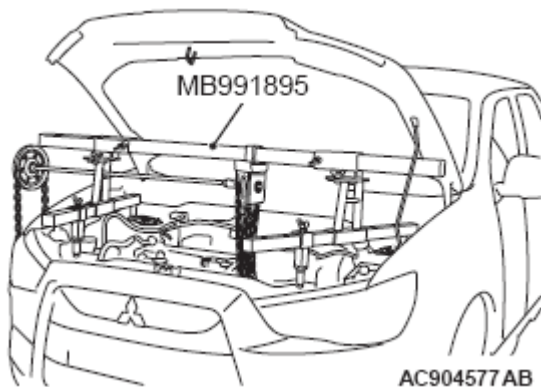


Fig. 96: Identifying Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Secure special tool MB991454 to the engine hanger and idler pulley bracket.
3. Adjust the special tool not to allow the weight of the engine and transaxle assembly to rest on the engine mounting insulator. Then remove the engine mounting insulator.

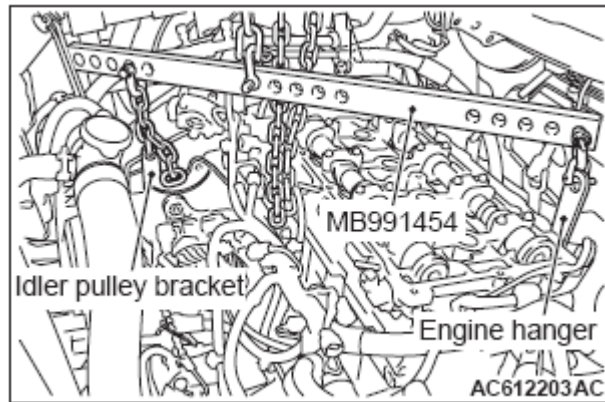


Fig. 97: Securing Special Tool MB991454 To Engine Hanger And Idler Pulley Bracket
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< C >> TIMING CHAIN CASE ASSEMBLY REMOVAL

CAUTION: If the adhesive strength of sealant on the timing chain case assembly is so strong that the boss may be damaged by peeling off, do not peel it off forcibly.

1. After removing the timing chain case assembly mounting bolts, slightly pry the boss of the timing chain case assembly shown in the illustration using a flat-tipped screwdriver, and remove the timing chain case assembly from the cylinder head and cylinder block.

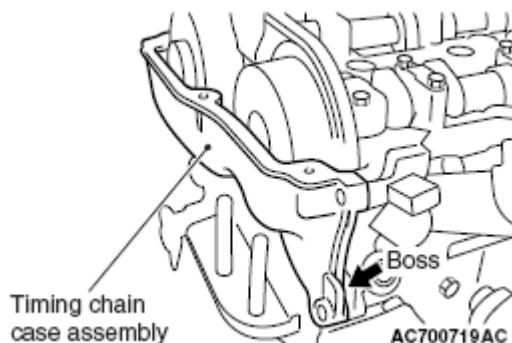


Fig. 98: Identifying Timing Chain Case Assembly And Boss
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. If the sealant cannot be peeled off easily, insert a wooden hammer shank into the timing chain case assembly inside as shown in the illustration, pry slightly, and remove the timing chain case assembly from the cylinder head and cylinder block.

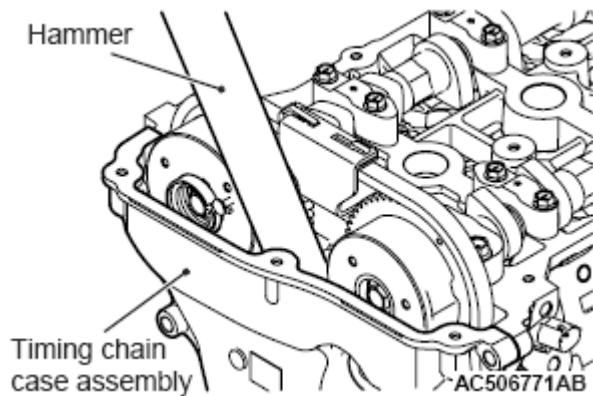


Fig. 99: Inserting Wooden Hammer Shank Into Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< D >> TIMING CHAIN TENSIONER REMOVAL

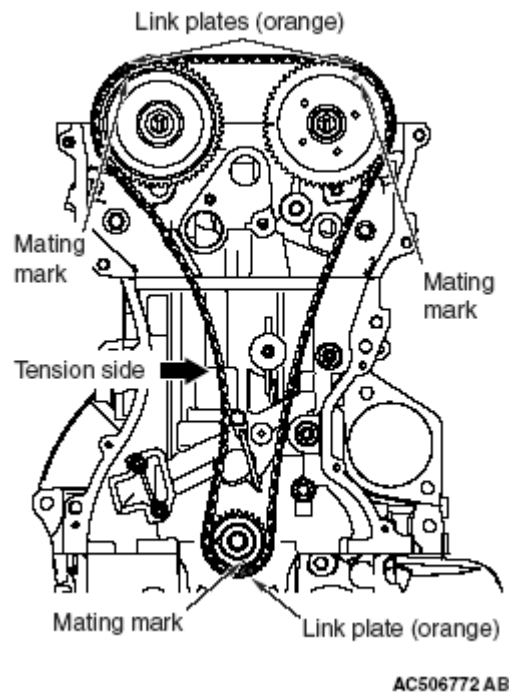
1. Temporarily install the crankshaft pulley to the crankshaft.

CAUTION: Turn the crankshaft clockwise.

2. Turn the crankshaft clockwise to align the sprocket timing marks as shown in the illustration and set the number 1 cylinder to the top dead center of compression.

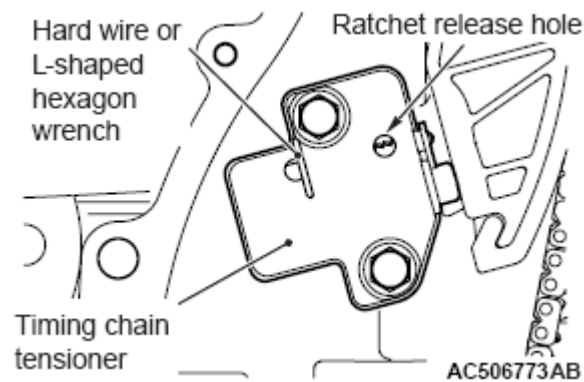
NOTE: At this time, it is not necessary that the link plate (orange and blue) of the valve timing chain always aligns with each sprocket timing mark.

3. Remove the crankshaft pulley installed temporarily.

**Fig. 100: Removing Timing Chain Tensioner (1 Of 2)**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Using a precision flat-tipped screwdriver, release the ratchet of timing chain tensioner.
5. Compress the plunger of timing chain tensioner and insert hard wire (such as piano wire) or the L-shaped hexagon wrench [1.5 mm(0.06 inch)] to fix the plunger of the timing chain tensioner.

**Fig. 101: Removing Timing Chain Tensioner (2 Of 2)**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Remove the timing chain tensioner.

INSTALLATION SERVICE POINTS**>> A << VALVE TIMING CHAIN INSTALLATION**

1. Set the timing marks of the camshaft sprockets and the crankshaft sprocket as shown in the illustration.

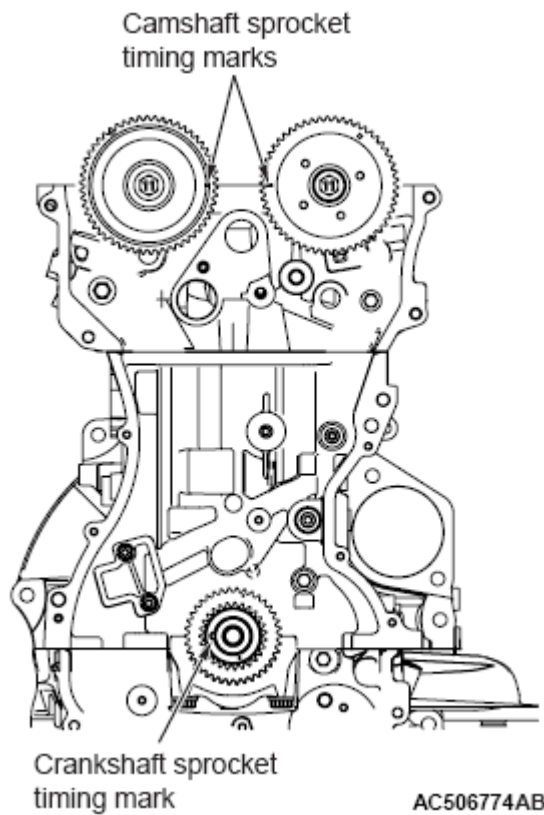
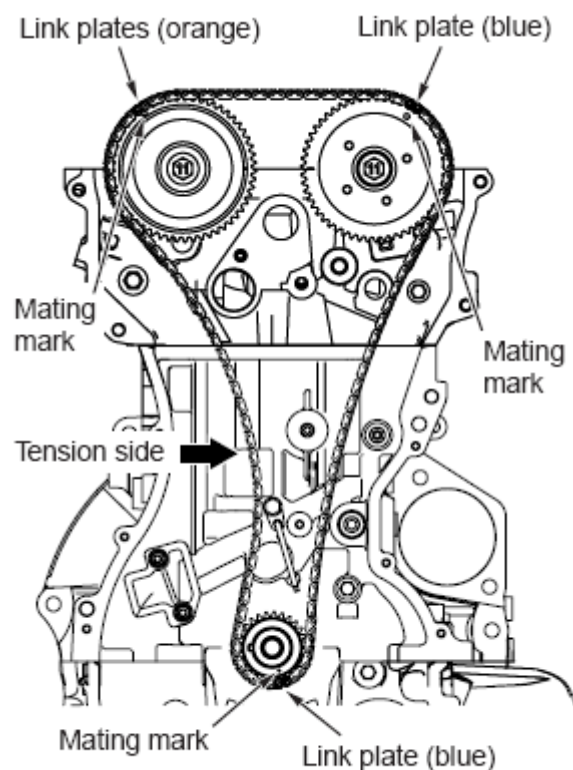


Fig. 102: Identifying Timing Marks Of Camshaft Sprockets And Crankshaft Sprocket
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Align each sprocket timing chain mating mark with the link plate (orange and blue) of valve timing chain to avoid slack of the valve timing chain tension side, and install the valve timing chain to the sprockets.



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Fig. 103: Aligning Each Sprocket Timing Chain Mating Mark With Link Plate (Orange And Blue) Of Valve Timing Chain

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << TIMING CHAIN TENSIONER INSTALLATION

1. Check that the sprocket timing chain mating marks align with the link plates (orange and blue) of the valve timing chain, and install the timing chain tensioner to the cylinder block.

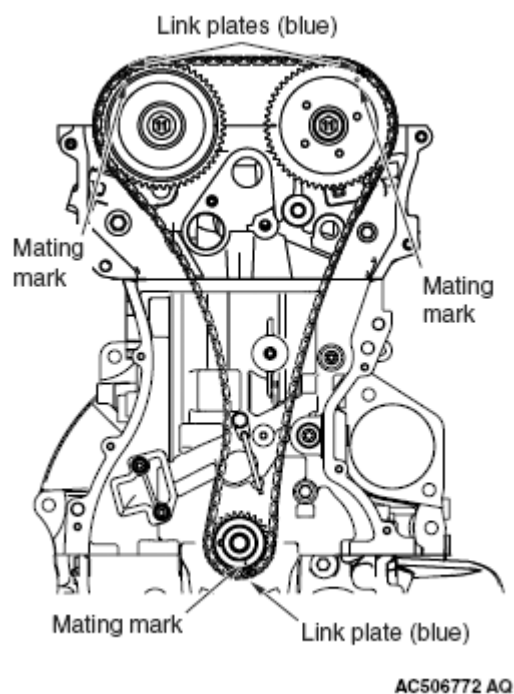


Fig. 104: Aligning Sprocket Timing Chain Mating Marks With Link Plates (Orange And Blue) Of Valve Timing Chain

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the hard wire or L-shaped hexagon wrench fixing the plunger of the timing chain tensioner to apply tension to the valve timing chain.

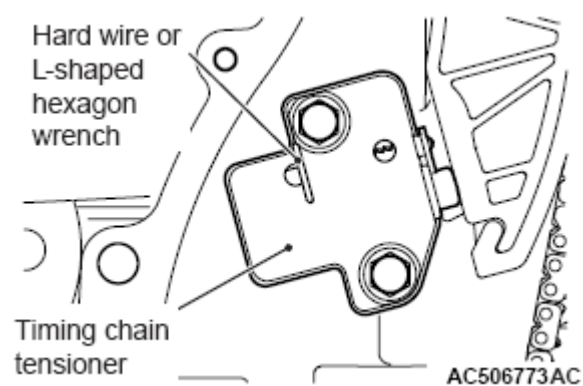


Fig. 105: Applying Tension To Valve Timing Chain

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << TIMING CHAIN CASE ASSEMBLY INSTALLATION

CAUTION:

- Be sure to remove the sealant inside the mounting holes and the O-ring grooves.
- After degreasing with white gasoline or the like, check that there is

no oil on the surface where the sealant is applied.

- **After degreasing with white gasoline or the like, never touch the degreased area with fingers.**

1. Completely remove the liquid gasket adhered to the timing chain case assembly, cylinder block and cylinder head, and then degrease using the volatile degreasing agent.
2. Remove all the sealant adhering to the gasket between the cylinder head and cylinder block (three-surface aligned part). Then, degrease the surfaces with the volatile degreasing agent.
3. As for the three-surface aligned part above, the engine oil oozes from the cylinder head gasket. Thus, quickly apply the sealant to it after degreasing.

Specified sealant: ThreeBond 1217G or equivalent

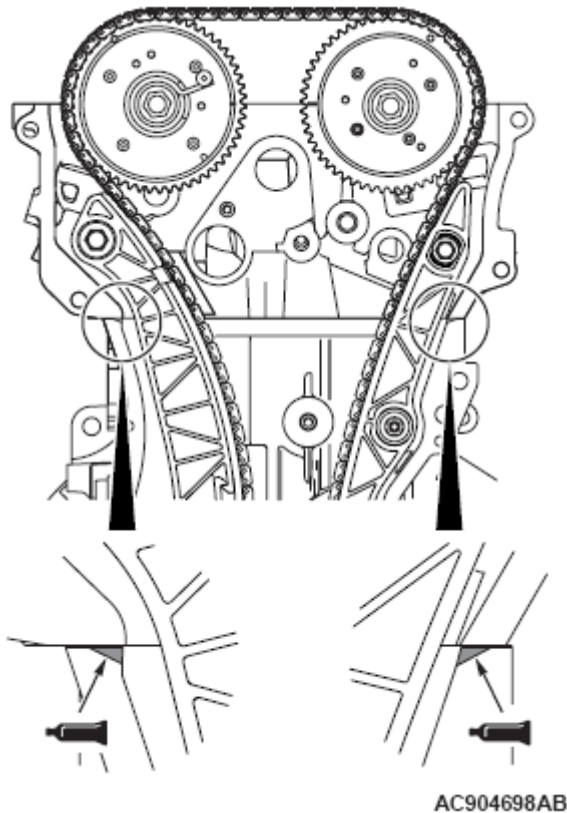
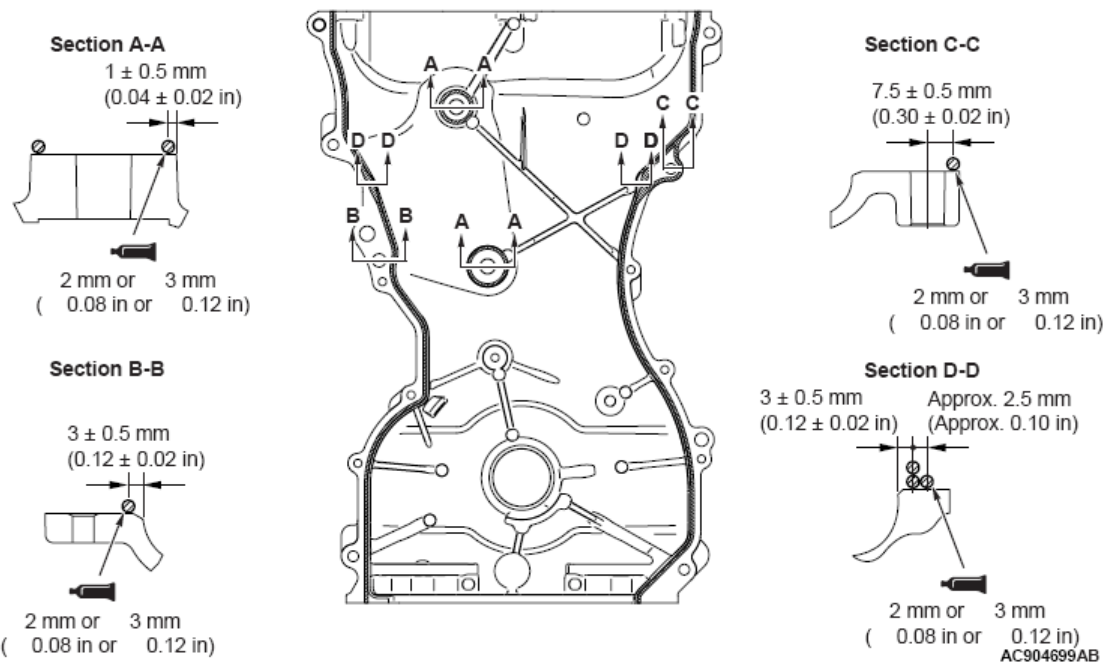


Fig. 106: Identifying Sealant Application Area (1 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

**Fig. 107: Identifying Sealant Application Area (2 Of 2)**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. To the timing chain case assembly installation surface, apply the sealant without a gap. However, overlap the sealant at the "D" shown in the illustration.

Specified sealant: ThreeBond 1217G or equivalent

NOTE: Install the timing chain case assembly immediately after applying sealant.

CAUTION:

- If the sealant contacts any other part during installation of the timing chain case assembly, apply sealant again before installing the timing chain case assembly.
- After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the oil or water to the sealant application area or start the engine.

5. Install the timing chain case assembly to the cylinder block and cylinder head so that the sealant does not contact other parts.
6. Insert the bolts to the timing chain case assembly as shown in the illustration, and tighten them to the specified torque.

BOLT SPECIFICATION

Name	Symbol	Quantity	Size mm (D x L)
Flange bolt	A	6	M6 x 25
	B	6	M8 x 30

Bolt	C	1	M6 x 25
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NOTE: D: Nominal diameter, L: Nominal length

Tightening torque:

A, C: 10 ± 2 N.m (89 ± 17 in-lb)

B: 24 ± 4 N.m (18 ± 2 ft-lb)

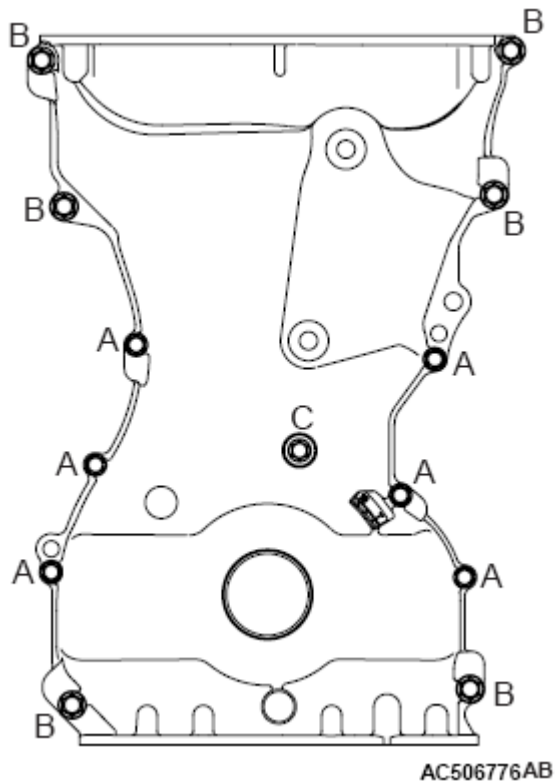


Fig. 108: Installing Timing Chain Case Assembly Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> D << WATER PUMP PULLEY INSTALLATION

Temporarily tighten the water pump pulley mounting bolts. Then, tighten them to the specified torque after the installation of drive belt.

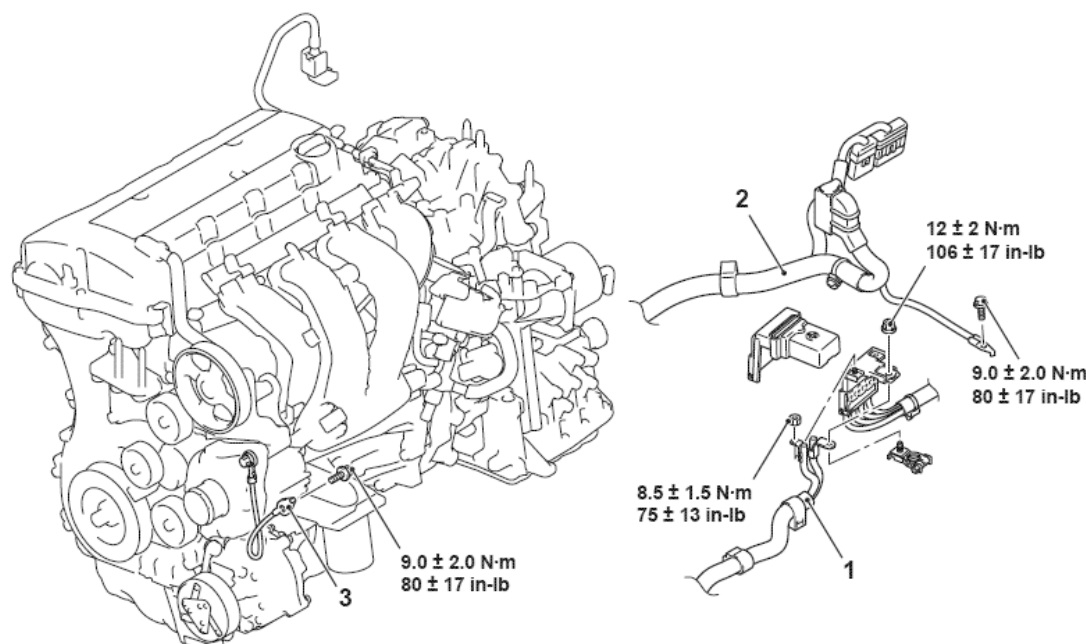
ENGINE ASSEMBLY

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 <ul style="list-style-type: none"> • Hood Removal • Fuel Line Pressure Reduction • Engine Room Under Cover Front A, B and Engine Room Side Cover Removal • Engine Coolant Draining • Engine Oil Draining • Transaxle Oil Draining <M/T> • Transmission Fluid Draining <CVT> • Transfer Oil Draining <AWD> • Engine Upper Cover Removal • Air Cleaner Assembly and Air Cleaner Bracket Removal • Battery and Battery Tray Removal • Exhaust Manifold Removal • Drive Belt Removal 	Post-installation Operation <ul style="list-style-type: none"> • Drive Belt Installation • Exhaust Manifold Installation • Battery and Battery Tray Installation • Air Cleaner Assembly and Air Cleaner Bracket Installation • Engine Upper Cover Installation • Transfer Oil Refilling <AWD> • Transaxle Oil Refilling <M/T> • Transmission Fluid Refilling <CVT> • Engine Oil Refilling • Engine Coolant Refilling • Drive Belt Tension Check • Fuel Leak Check. • Engine Room Under Cover Front A, B and Engine Room Side Cover Installation • Hood Installation
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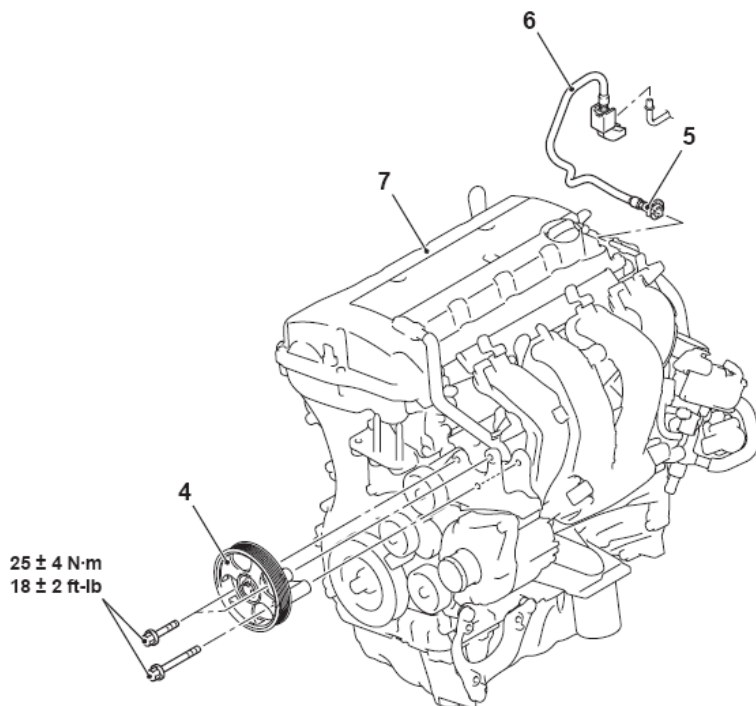
AC904597AB

Removal steps

1. Battery wiring harness connection
 2. Control wiring harness connection
 3. Grounding cable connection
- Heater hose connection
 - Radiator upper hose connection
 - Radiator lower hose connection

Fig. 109: Identifying Engine Assembly Remove/Install Components With Torque Specifications (1 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



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Removal steps			
<<A>>	• A/C compressor and clutch assembly	<<D>>	• Transaxle assembly <M/T>
<>	• Radiator cap assembly bracket	<<D>>	• Transaxle assembly <CVT>
4.	Idler pulley and bracket	<<E>> >>B<<	• Engine mounting bracket
5.	Fuel high-pressure hose connection	<<F>> >>A<<	7. Engine assembly
<<C>> >>C<<	6. Fuel high-pressure hose		

Fig. 110: Identifying Engine Assembly Remove/Install Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991928: Engine Hanger
- MB991895: Engine Hanger
- MB991527: Hanger
- MB992201: Engine Hanger Plate
- MB991454: Engine Hanger Balancer

REMOVAL SERVICE POINTS

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

1. Remove the A/C compressor and clutch assembly together with the hose from the bracket.
2. Tie the removed A/C compressor and clutch assembly with a string at a position where it will not interfere with the removal and installation of engine assembly.

<< B >> RADIATOR CAP ASSEMBLY BRACKET REMOVAL

1. Remove the radiator cap assembly bracket mounting bolts at the headlight support upper panel.
2. Remove the radiator cap assembly from the headlight support upper panel with the bracket and the hose attached.
3. Tie the removed radiator cap assembly with a cord in a place where it will not be a hindrance when removing and installing the engine assembly.

<< C >> FUEL HIGH-PRESSURE HOSE REMOVAL

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

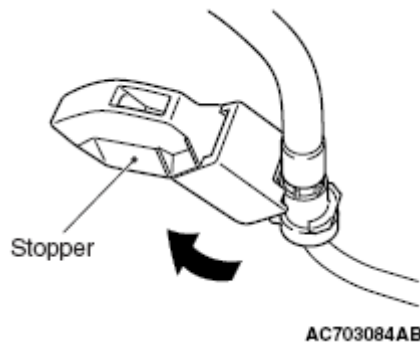


Fig. 111: Removing Stopper Of Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

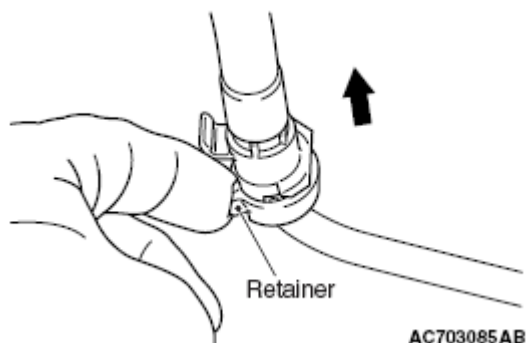


Fig. 112: Pulling Out Fuel High-Pressure Hose

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< D >> TRANSAXLE ASSEMBLY REMOVAL

1. Install the engine hanger, which has been removed when the exhaust manifold is removed (Refer to **EXHAUST MANIFOLD**).
2. Remove the transaxle assembly (Refer to **TRANSAXLE ASSEMBLY**) < M/T > or (Refer to **TRANSAXLE ASSEMBLY**) < CVT >.

<< E >> ENGINE MOUNTING BRACKET REMOVAL

CAUTION: When supporting the engine assembly with a garage jack, be careful not to deform the engine oil pan.

1. Place a garage jack against the engine oil pan with a piece of wood in between to support the engine assembly.
2. Remove the special tools for holding the engine assembly, which has been set when the transaxle assembly is removed.
 - MB991928 or MB991895
 - MB991527
 - MB992201

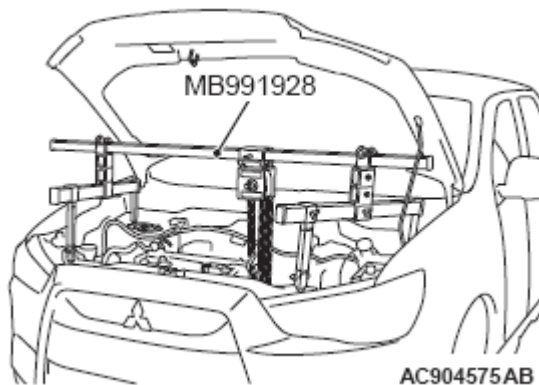


Fig. 113: Identifying Special Tool MB991928

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

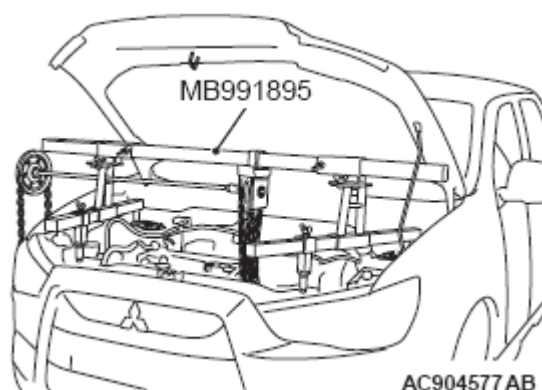


Fig. 114: Identifying Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

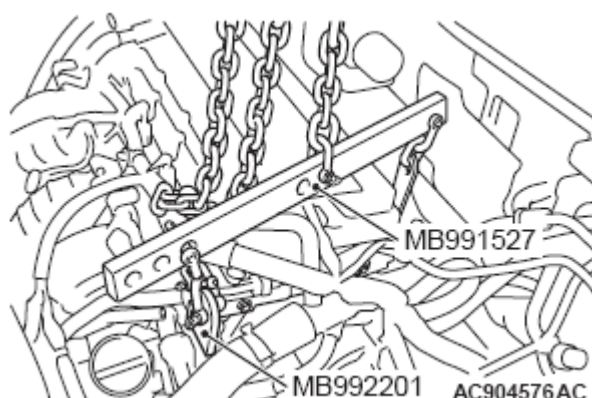


Fig. 115: Identifying Special Tool MB991527 And MB992201
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Secure special tool MB991454 to the engine hanger and idler pulley bracket in order to hold the engine assembly.
4. Operate a garage jack so that the engine weight is not applied to the engine mounting insulator, and remove the engine mounting bracket.

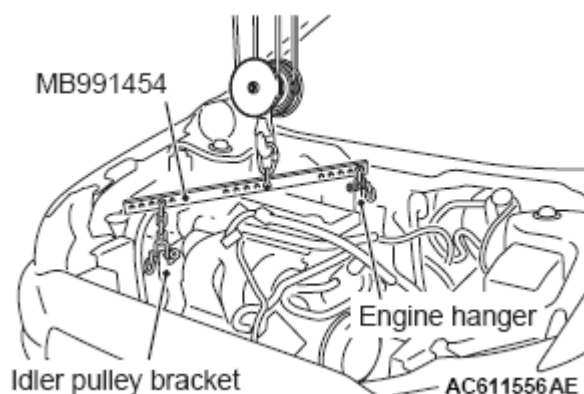


Fig. 116: Securing Special Tool MB991454 To Engine Hanger And Idler Pulley Bracket

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< F >> ENGINE ASSEMBLY REMOVAL

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

INSTALLATION SERVICE POINTS

>> A << ENGINE ASSEMBLY INSTALLATION

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

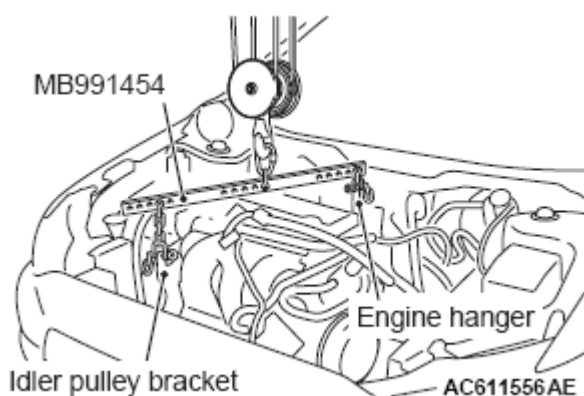


Fig. 117: Installing Engine Assembly

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << ENGINE MOUNTING BRACKET INSTALLATION

CAUTION: When supporting the engine assembly with a garage jack, be careful not to deform the engine oil pan.

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mounting bracket while adjusting the position of the engine.
2. Remove special tool MB991454, which has been secured on the engine assembly.

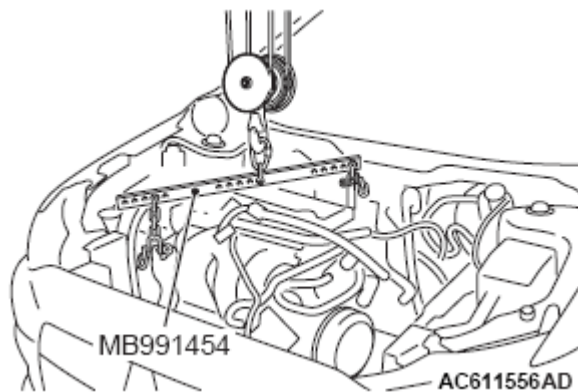


Fig. 118: Identifying Special Tool MB991454

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Secure the special tools for holding the engine assembly, which will be used when the transaxle assembly is installed (Refer to **TRANSAXLE ASSEMBLY**) < M/T > or (Refer to **TRANSAXLE ASSEMBLY**) < CVT >.
 - MB991928 or MB991895
 - MB991527
 - MB992201
4. Remove the garage jack which supports the engine assembly.

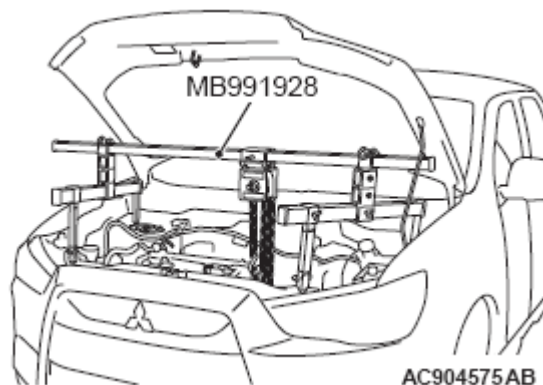


Fig. 119: Identifying Special Tool MB991928

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

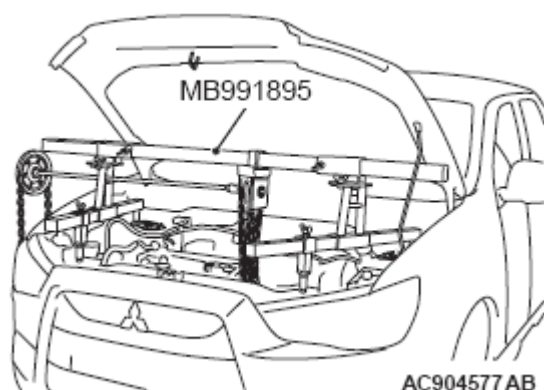


Fig. 120: Identifying Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

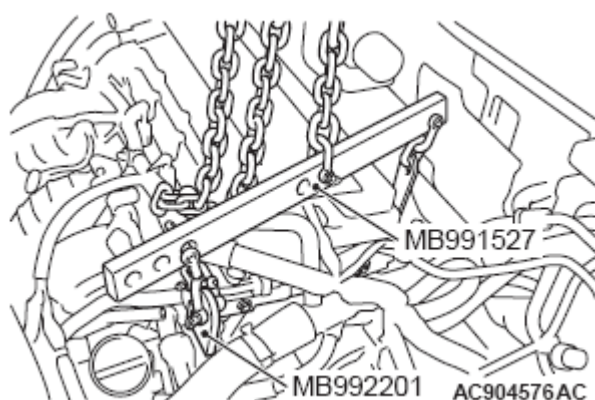


Fig. 121: Identifying Special Tool MB991527 And MB992201
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << FUEL HIGH-PRESSURE HOSE INSTALLATION

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.

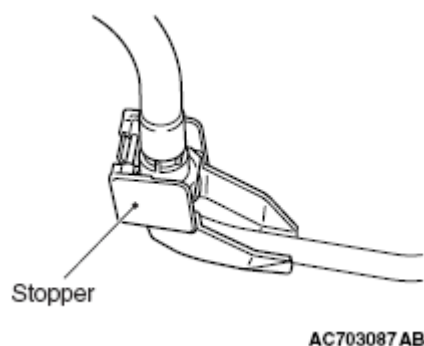


Fig. 122: Installing Fuel High-Pressure Hose

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.