2009 ENGINE

Engine Mechanical (2.4L) - Outlander

GENERAL INFORMATION

The 4B12 (2.4 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 belt side). The firing order is 1-3-4-2.

GENERAL SPECIFICATION

ITEMS			SPECIFICATIONS
Type			In-line DOHC
Number of cylinders			4
Bore mm (in)			88 (3.46)
Stroke mm (in)			97 (3.82)
Total displacement cm^3 (cu. in)			2,359
Compression ratio			10.5
Firing order			1-3-4-2
Valve timing	Intake valve	Opens (BTDC)	0-40°
		Closes (ABDC)	64° - 24°
	Exhaust valve	Opens (BBDC)	44° - 24°
		Closes (ATDC)	0-20°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type

ENGINE DIAGNOSIS

ENGINE SPECIFICATION

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.
	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)	-
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		650 ± 100	-
Compression pressure (200 r/min) kPa (psi)		1,440 (209)	Minimum 1,000 (145)
Compression pressure difference of all cylinder kPa (psi)		-	98 (14)
Intake manifold vacuum at curb idle kPa (in Hg)		-	Minimum 60 (18)

SEALANTS

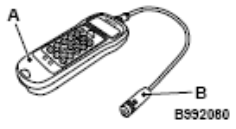
SEALANTS SPECIFICATION

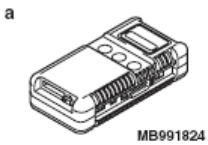
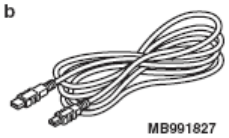
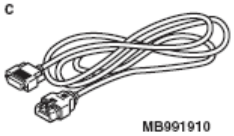
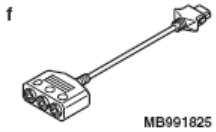
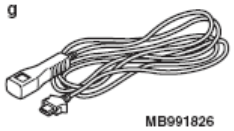
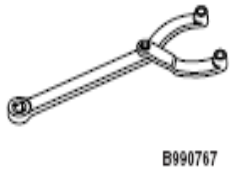
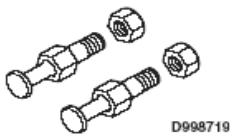
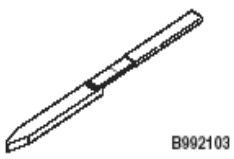
Item	Specified Sealant
Cylinder head cover (matching area of the cylinder head and the timing chain case assembly)	Three bond 1217G (Mitsubishi Genuine Part No.1000A923), Three bond 1227D
Engine oil pan	Three bond 1217G (Mitsubishi Genuine Part No.1000A923), Three bond 1227D, Three bond 1207F (Mitsubishi Genuine Part No.MD970389), LOCTITE 5971, LOCTITE 5970, LOCTITE 5900
Drive plate bolt	Three bond 1324 or equivalent

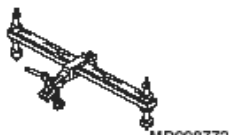
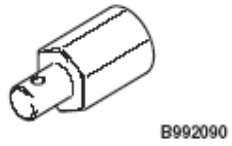
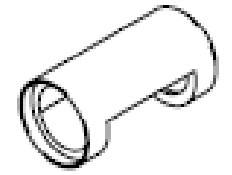
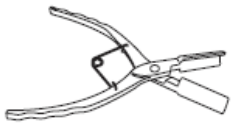
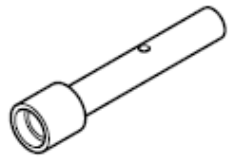
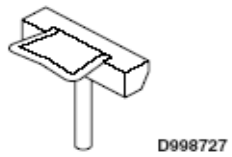
Cylinder head gasket (matching area of the cylinder block and the cylinder head)	Three bond 1217G (Mitsubishi Genuine Part No.1000A923)
Timing chain case assembly	Three bond 1217G (Mitsubishi Genuine Part No.1000A923)

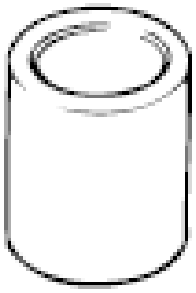
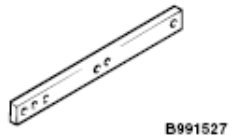
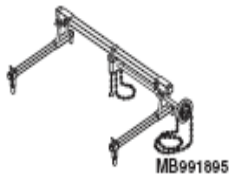
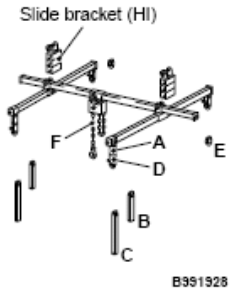
SPECIAL TOOLS

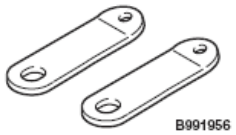
SPECIAL TOOLS REFERENCE

Tool	Tool No. & Name	Supersession	Application
	MB992080 Belt tension meter set a. MB9912081 Belt tension meter b. MB992082 Mic assembly	Tool not available	Drive belt tension (frequency) measurement
	MB991958 Scan tool (M.U.T.-III sub assembly) a. MB991824 Vehicle communication interface (V.C.I.) b. MB991827 M.U.T.-III USB cable c. MB991910 M.U.T.-III main harness A (Vehicles with CAN communication system) d. MB991911 M.U.T.-III main harness B (Vehicles	MB991824-KIT **NOTE:** **MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.**	**CAUTION:** **For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** • Standard ignition timing check • Idle speed check

a  MB991824 b  MB991827 c  MB991910 d  MB991911 e  MB991914 f  MB991825 g  MB991826 MB991958	without CAN communication system) e. MB991914 M.U.T.-III main harness C (for Chrysler models only) f. MB991825 M.U.T.-III adapter harness g. MB991826 M.U.T.-III trigger harness		
 B990767	MB990767 Front hub and flange yoke holder	MB990767-01	Holding the camshaft sprocket
 D998719	MD998719 Pin	MIT308239	
 B992103	MB992103 Chain tension release bar	-	Camshaft and camshaft sprocket assembly (exhaust side) removal
	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
 D998727	MD998727 Oil pan FIPG cutter	MD998727-01	Oil pan removal
 MB991883	MB991883 Flywheel stopper	General service tool	Supporting the flywheel
	MD998718 Crankshaft rear oil seal installer	MD998718-01	Press-fitting the crankshaft rear oil seal
	MB991448 Bush remover and installer base	MB991448-01	Press-fitting the crankshaft front oil seal

			
	MB991614 Angle gauge	-	Cylinder head bolt installation
	MB991454 Engine hanger balancer	MZ203827-01	When the engine hanger is used: Supporting the engine assembly during removal and installation of the transaxle assembly **NOTE:** **Special tool MB991454 is a part of engine hanger attachment set MB991453.**
	MB991527 Hanger	Tool not available	
	MB991895 Engine hanger	Tool not available	
	MB991928 Engine hanger a. MB991929 Joint (50) x 2 b. MB991930 Joint (90) x 2 c. MB991931 Joint (140) x 2 d. MB991932	Tool not available	

	Foot (standard) x 4 e. MB991933 Foot (short) x 2 f. MB991934 Chain and hook assembly		
 B991956	MB991956 Engine hanger plate	-	

ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK

1. Remove the radiator condenser tank mounting bolts.
2. Move the radiator condenser tank to a place where it will not be a hindrance when checking the drive belt tension.

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

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

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

5. Tighten the radiator condenser tank mounting bolts to the specified torque.

Tightening torque: 12 ± 2 N.m (102 ± 22 in-lb)

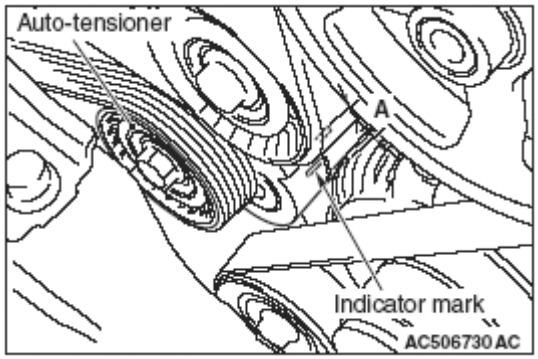


Fig. 1: Identifying Indicator Mark On Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

AUTO-TENSIONER CHECK

OPERATION CHECK

1. Turn off the engine from the idle state then check to see that the drive belt is not protruding from the pulley width of the auto-tensioner.
2. Remove the drive belt (Refer to **CRANKSHAFT PULLEY**).
3. Rotate the pulley bolt of the auto-tensioner clockwise and counterclockwise with an offset wrench [45°, a long offset wrench (5/8 x 11/16 inches) recommended] to check for binding.
4. If there are any problems in the procedure 1 or 3, replace the auto-tensioner (Refer to **TIMING CHAIN**).
5. Install the drive belt (Refer to **CRANKSHAFT PULLEY**).

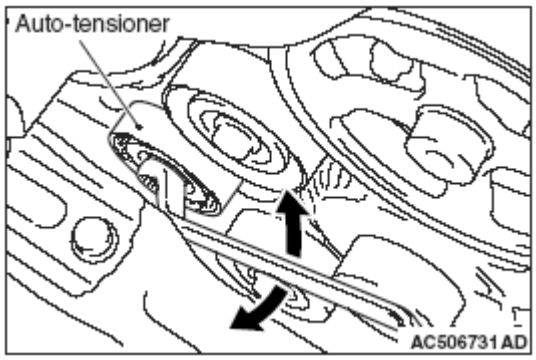


Fig. 2: Identifying Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

FUNCTION CHECK

The 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: Mic Assembly

1. Check the tension of the drive belt (Refer to **ON-VEHICLE SERVICE**).
2. Check the tension of the drive belt in the following procedures.
   1. Connect special tool microphone assembly (MB992082) to special tool belt tension meter (MB992081) of special tool belt tension meter set (MB992080).
   2. Press the "POWER" button to turn on the power supply.
   3. Press the numeral key of "1" and check that "No. 1" appears on the upper left of the display.

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

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

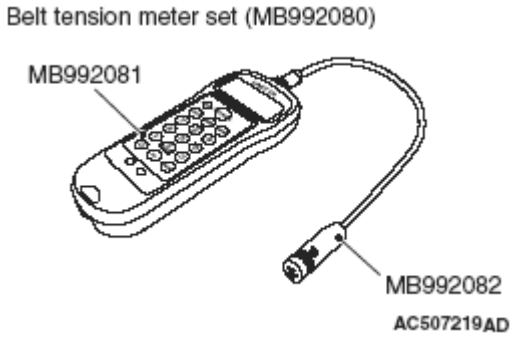


Fig. 3: Identifying Special Tool Microphone Assembly (MB992082) To Special Tool Belt Tension Meter (MB992081)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION:
- **The temperature of the surface of the belt should be as close to normal temperature as possible.**
- **Do not allow any contaminants such as water or oil to get onto the microphone.**
- **If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.**
- **If the microphone is touching the belt while the measurement is being made, the values measured by the**

microphone may not correspond to actual values.

- **Do not take the measurement while the vehicle's engine is running.**

5. Hold special tool 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 degree).
6. Press the "MEASURE" button.
7. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and 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.

3. If not within the standard value, replace the auto-tensioner (Refer to **TIMING CHAIN**).

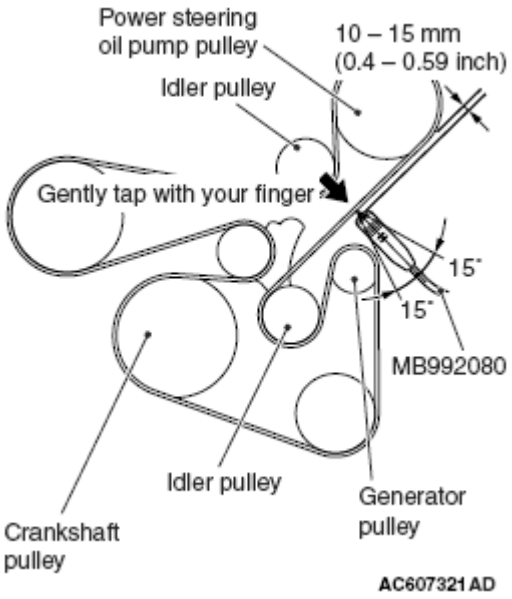


Fig. 4: Holding Special Tool MB992080 To Middle Of Belt Between Pulleys
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

< WHEN USING A TENSION GAUGE >

1. Check the tension of the drive belt (Refer to **ON-VEHICLE SERVICE**).
2. Use a belt tension gauge in the middle of the belt between the pulleys shown in the figure (at the place indicated by the arrow) to check that the belt tension is within the standard value.

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

3. If not within the standard value, replace the auto-tensioner (Refer to **TIMING CHAIN**).

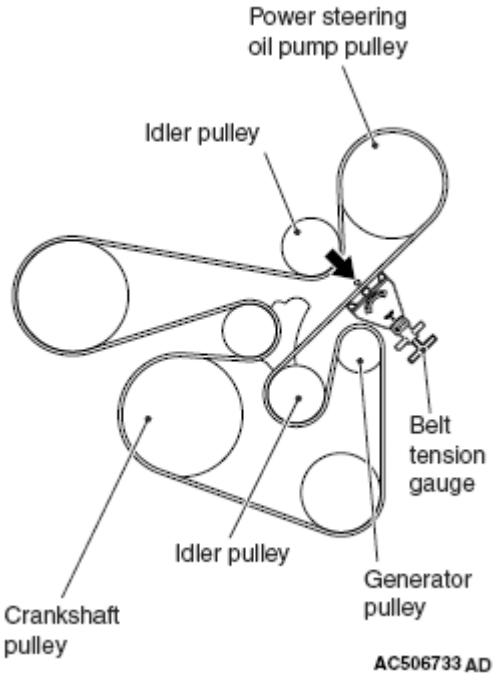


Fig. 5: Locating Tension Of Drive Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

VALVE CLEARANCE CHECK AND ADJUSTMENT

Refer to **GENERAL SPECIFICATION** for 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: P range

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

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

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

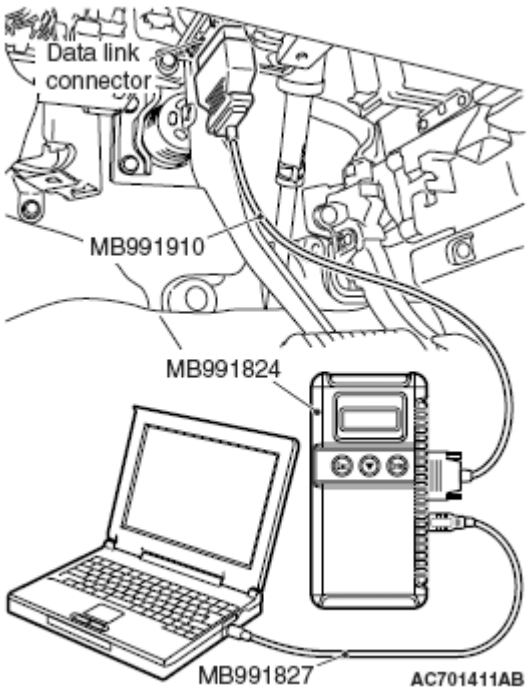


Fig. 6: Connecting Special Tool MB991827 To Special Tool MB991824 And Personal Computer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 650 r/min.
6. Select scan tool MB991958 actuator test "item number 11".
7. Check that basic ignition timing is within the standard value.

Standard value: 5° BTDC ± 3°

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

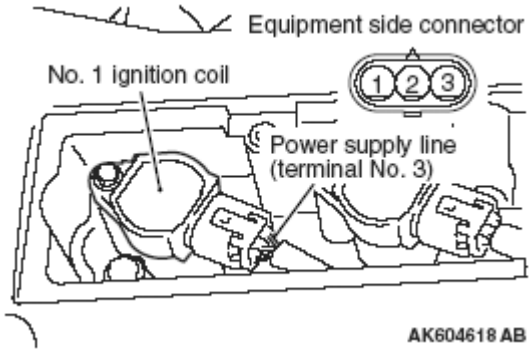


Fig. 7: Identifying Power Supply Line (Terminal No. 3) Of Ignition Coil No. 1
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

Standard value: Approximately 10° BTDC

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

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

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

11. Remove the timing light.

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

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

CURB IDLE SPEED CHECK

Required Special Tool:

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

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

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

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

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

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

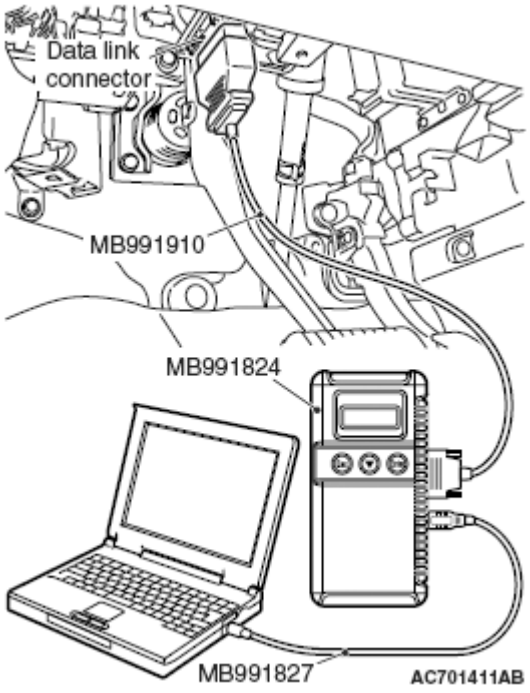


Fig. 8: Connecting Special Tool MB991827 To Special Tool MB991824 And Personal Computer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 ±7°, even under normal operating condition.

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

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

   Curb idle speed: 700 ± 100 r/min

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

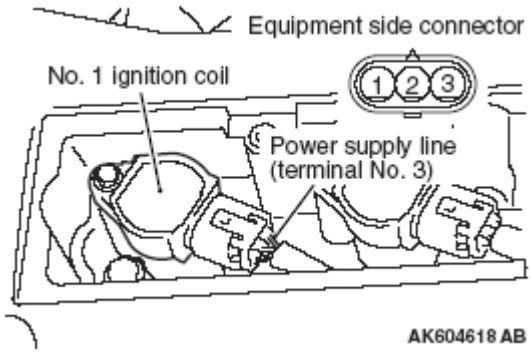


Fig. 9: Identifying Power Supply Line (Terminal No. 3) Of Ignition Coil No. 1
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   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: P range

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

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

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

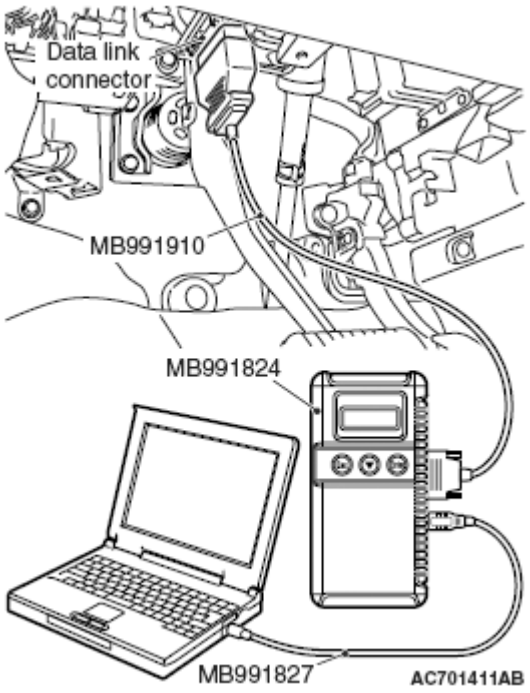


Fig. 10: Connecting Special Tool MB991827 To Special Tool MB991824 And Personal Computer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

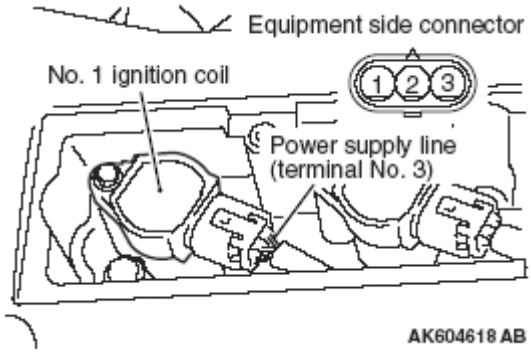


Fig. 11: Identifying Power Supply Line (Terminal No. 3) Of Ignition Coil No. 1
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Run the engine and increase the engine speed to 2,500 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 timing light.

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

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

COMPRESSION PRESSURE CHECK

Required Special Tool:

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

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

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

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

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

4. 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.

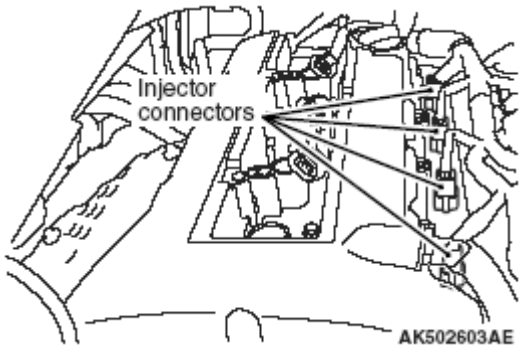


Fig. 12: Identifying Injector Connectors
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Set compression gauge to one of the spark plug holes.
6. Crank the engine with the throttle valve fully open and measure the compression pressure.

Standard value (at engine speed of 200 r/min): 1,440 kPa (209 psi)

Limit (at engine speed of 200 r/min): Minimum 1,000 kPa (145 psi)

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

   Limit: Maximum 98 kPa (14 psi)

8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps from 5 to 7.

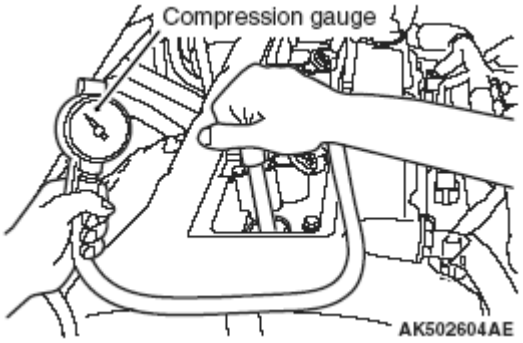


Fig. 13: Measuring Compression Pressure Of Cylinders
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

9. Connect the all of the injector connector.
10. Install the spark plugs and ignition coils.
11. Use the scan tool MB991958 to erase the diagnosis codes.

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

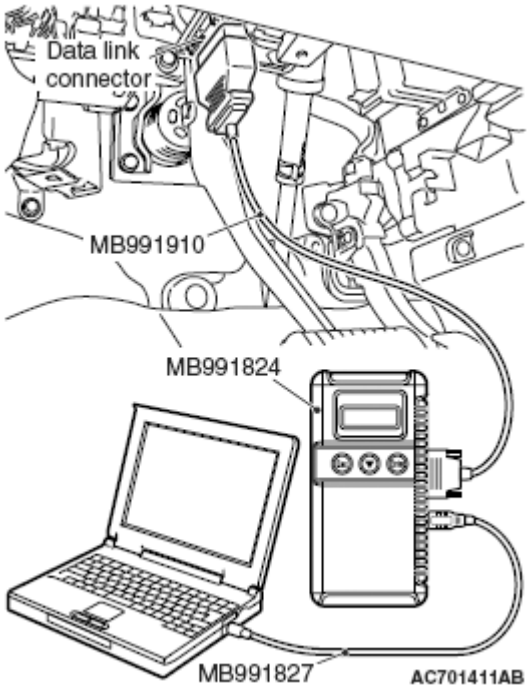


Fig. 14: Connecting Special Tool MB991827 To Special Tool MB991824 And Personal Computer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

MANIFOLD VACUUM CHECK

Required Special Tool:

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

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

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

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

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

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

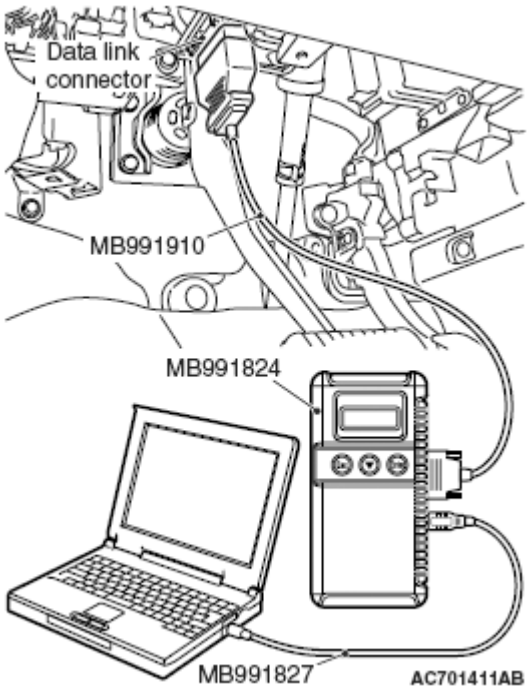


Fig. 15: Connecting Special Tool MB991827 To Special Tool MB991824 And Personal Computer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 650 r/min.
5. Check the intake manifold vacuum.

   Limit: Minimum 60 kPa (18 in Hg)

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.

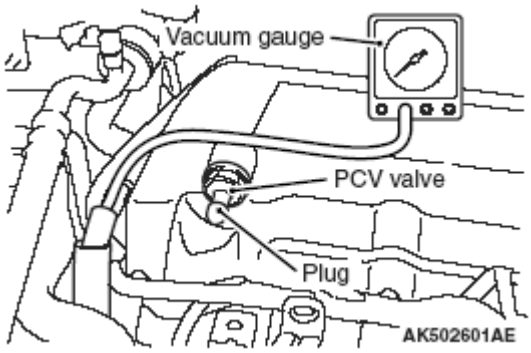
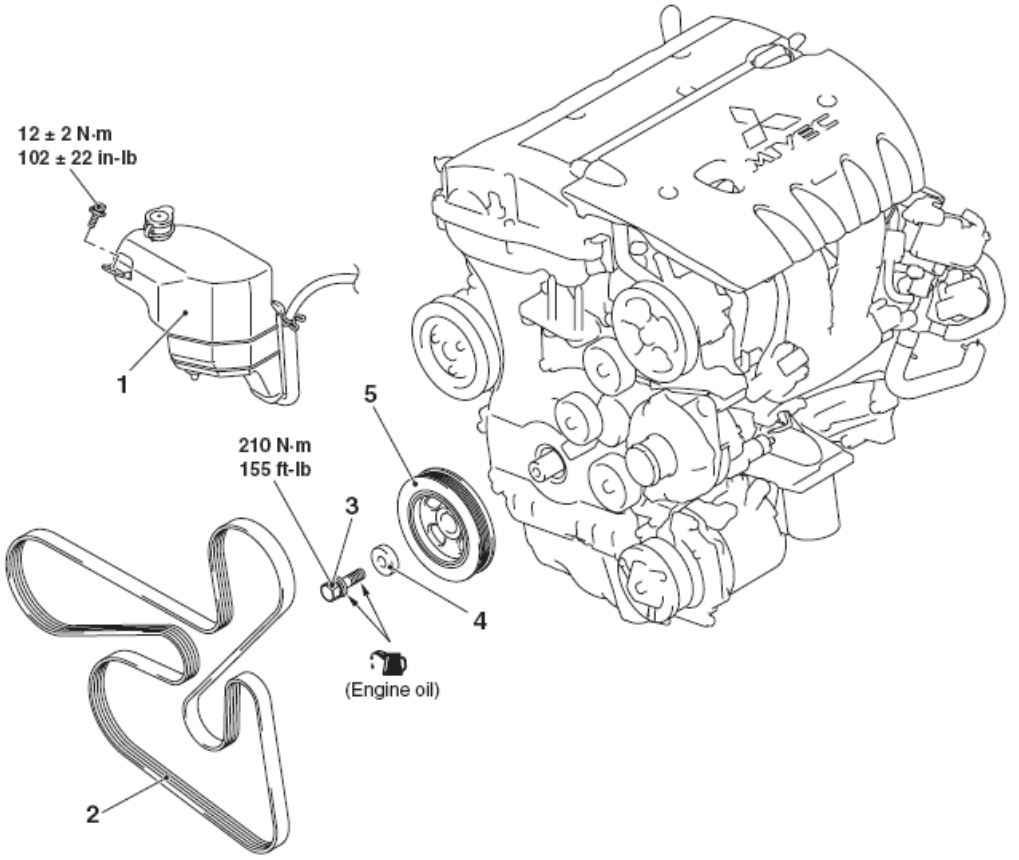


Fig. 16: Checking Intake Manifold Vacuum
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

Pre-removal operation	Post-installation operation
• Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal	• Drive Belt Tension Check • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation



			Removal steps				Removal steps (Continued)
<<A>>		1.	Radiator condenser tank assembly	<<C>>	>>A<<	4.	Crankshaft pulley washer
<<B>>	>>B<<	2.	Drive belt	<<C>>	>>A<<	5.	Crankshaft pulley
<<C>>	>>A<<	3.	Crankshaft pulley center bolt				

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

Required Special Tools:

- MB990767: Front Hub and Flange End Yoke Holder
- MD998719: Pin

REMOVAL SERVICE POINTS

<< A >> RADIATOR CONDENSER TANK ASSEMBLY REMOVAL

Remove the radiator condenser tank assembly mounting bolt, and move the radiator condenser tank assembly 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 drive belt 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.

1. Rotate the pulley bolt of the auto-tensioner counterclockwise with an offset wrench [45°, a long offset wrench (5/8 x 11/16 inches) recommended] and insert the hexagon wrench into the auto-tensioner hole to fix the auto-tensioner.
2. Remove the drive belt.

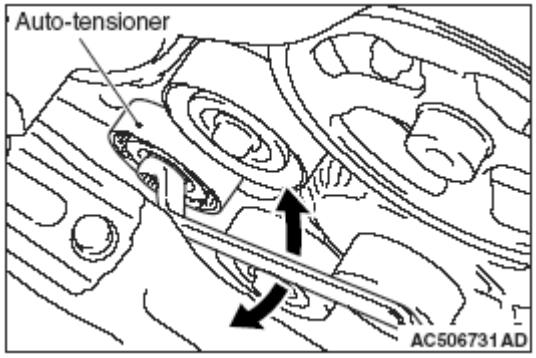


Fig. 18: Rotating Pulley Bolt Of Auto-Tensioner Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

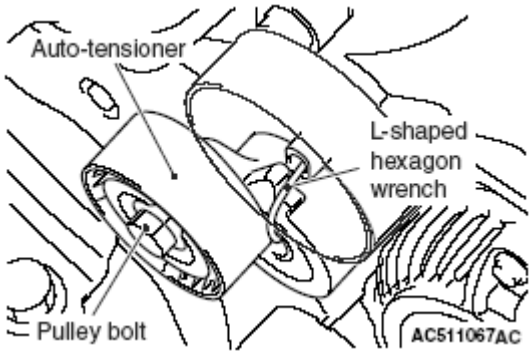


Fig. 19: Identifying Pulley Bolt And Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

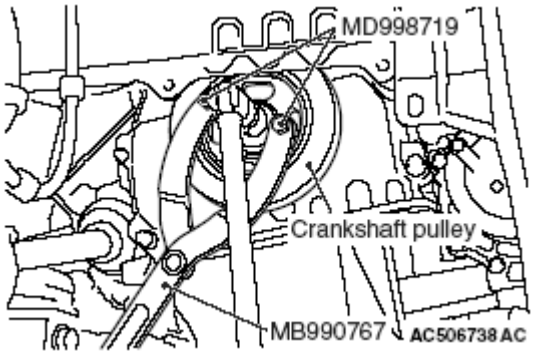


Fig. 20: Identifying Crankshaft Drive Sprocket With Special Tools MB990767 And MD998719
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

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

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

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

3. Install the crankshaft pulley.
4. Wipe off the dirt on the crankshaft pulley washer and the crankshaft pulley center bolt as shown in the figure using a rag.
5. Apply an adequate and minimum amount of engine oil to the threads 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.

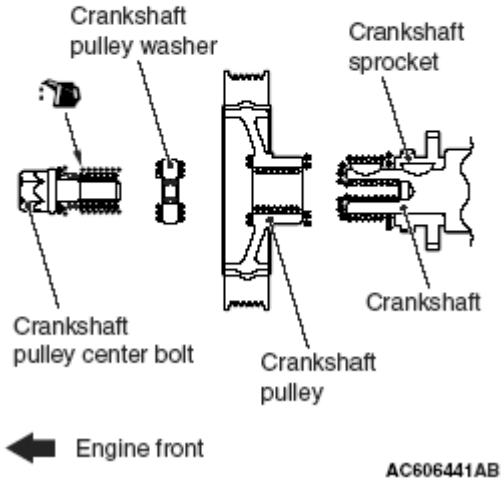


Fig. 21: Identifying Crankshaft Pulley Center Bolt, Crankshaft Pulley, Crankshaft And Crankshaft Pulley Washer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

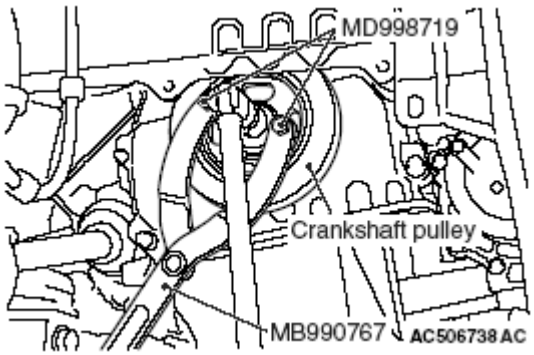


Fig. 22: Identifying Crankshaft Drive Sprocket With Special Tools MB990767 And MD998719
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> 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.**

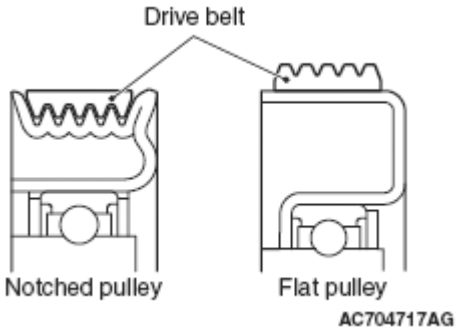


Fig. 23: Checking Drive Belt Center Of Flat Surface Of Flat Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

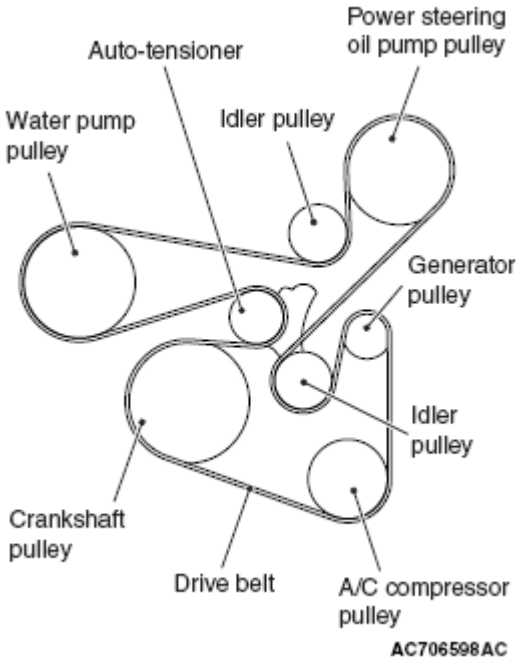


Fig. 24: Identifying Drive Belt And Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Set an offset wrench [45°, a long offset wrench (5/8 x 11/16 inches) recommended] to the pulley bolt of the auto-tensioner. Then, rotate the auto-tensioner anti-clockwise and remove the L-shaped hexagon wrench fixing the auto-tensioner.
3. Apply tension to the drive belt while slowly turning the auto-tensioner clockwise.

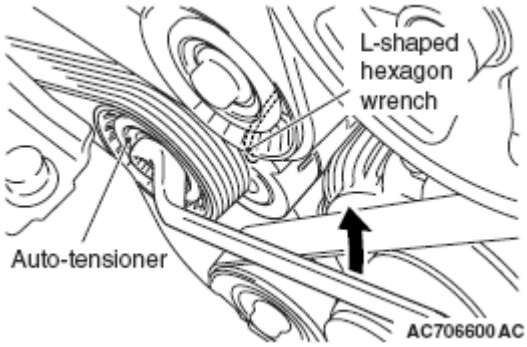
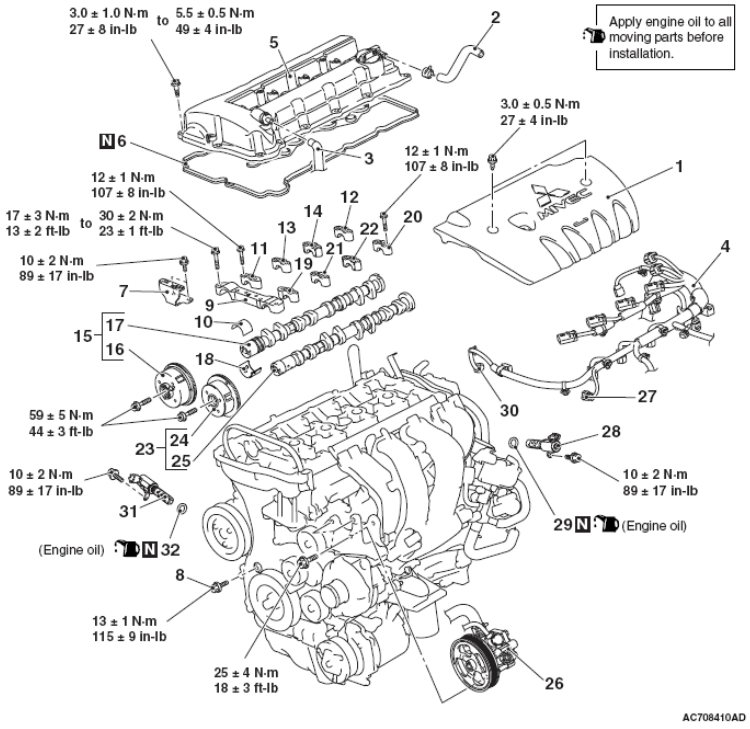


Fig. 25: Applying Tension To Drive Belt With Auto-Tensioner Clockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAMSHAFT

REMOVAL AND INSTALLATION

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal • Air Cleaner Assembly Removal • Strut Tower Bar Removal • Ignition Coil Removal	• Ignition Coil Installation • Strut Tower Bar Installation • Air Cleaner Assembly Installation • Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation



			Camshaft removal steps
		1.	Engine upper cover
		2.	Breather hose connection
		3.	PCV hose connection
		4.	Control wiring harness connection
<<A>>	>>G<<	5.	Rocker cover assembly
		6.	Rocker cover gasket
<<B>>		•	Cylinder No. 1 compression top dead center setting (only at removal).
		•	Valve clearance adjustment
		7.	Timing chain upper guide
		8.	Service hole bolt
<<C>>		•	Camshaft and camshaft sprocket assembly (exhaust side) removal preparatory operation (only at removal)
<<D>>	>>F<<	9.	Camshaft bearing front cap assembly
	>>E<<	10.	Camshaft bearing
<<E>>	>>D<<	11.	Camshaft bearing oil feeding cap (exhaust side)
<<E>>	>>D<<	12.	Camshaft bearing cap (exhaust side)
<<E>>	>>D<<	13.	Camshaft bearing cap (exhaust side)
<<E>>	>>D<<	14.	Camshaft bearing thrust cap (exhaust side)
<<F>>	>>E<<	15.	Camshaft and camshaft sprocket assembly (exhaust side)
<<G>>	>>B<<	16.	Camshaft sprocket (exhaust side)
<<G>>	>>B<<	17.	Camshaft (exhaust side)
	>>E<<	18.	Camshaft bearing
<<E>>	>>D<<	19.	Camshaft bearing oil feeding cap (intake side)
<<E>>	>>D<<	20.	Camshaft bearing cap (intake side)
<<E>>	>>D<<	21.	Camshaft bearing cap (intake side)
<<E>>	>>D<<	22.	Camshaft bearing thrust cap (intake side)
	>>C<<	23.	Camshaft and camshaft sprocket assembly (intake side)
<<G>>	>>B<<	24.	Camshaft sprocket (intake side)
<<G>>	>>B<<	25.	Camshaft (intake side)
			Oil control valve removal steps
		•	Drive belt
<<H>>		26.	Power steering oil pump assembly
		27.	Intake oil feeder control valve connector connection
<<I>>	>>A<<	28.	Intake oil feeder control valve
	>>A<<	29.	O-ring
		30.	Exhaust oil feeder control valve connector connection
<<I>>	>>A<<	31.	Exhaust oil feeder control valve
	>>A<<	32.	O-ring

Fig. 26: Identifying Camshaft Parts With Torque Specification
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 figure, and remove the rocker cover assembly.

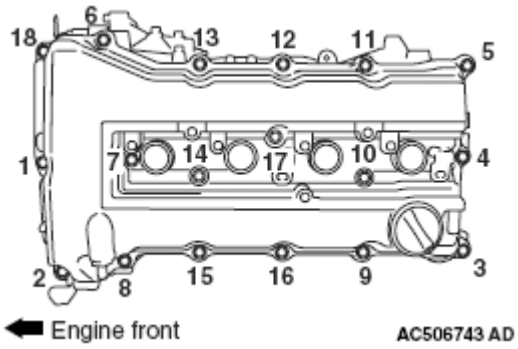


Fig. 27: Identifying Rocker Cover Assembly Mounting Bolts & Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> CYLINDER NO. 1 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 cylinder No. 1 to the top dead center of compression. At this time, check that the crankshaft pulley timing mark is in the 0-degree position of the ignition timing indicator of the timing chain case assembly.
2. Put paint marks on both the camshaft sprocket and timing chain at the position of camshaft sprocket timing chain mating mark (circular hole).

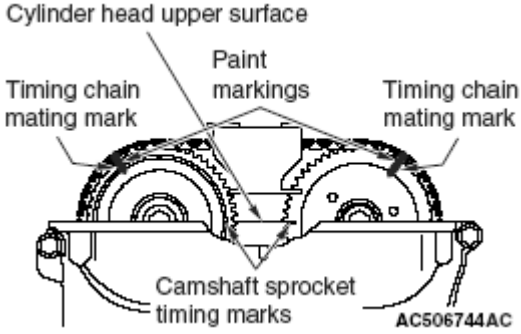


Fig. 28: Identifying Camshaft Timing Mark Locations
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< 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, 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.

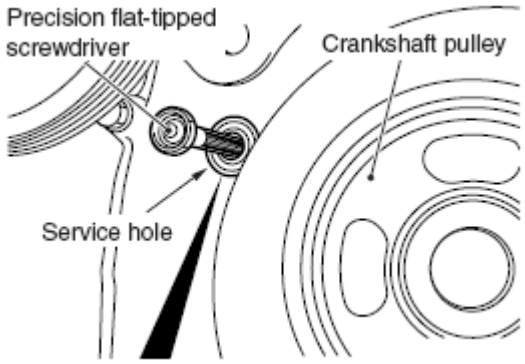


Fig. 29: Identifying Service Hole And Crankshaft Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

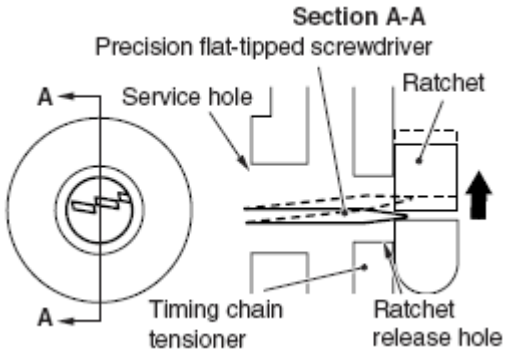


Fig. 30: Identifying Timing Chain Tensioner And Ratchet Release Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

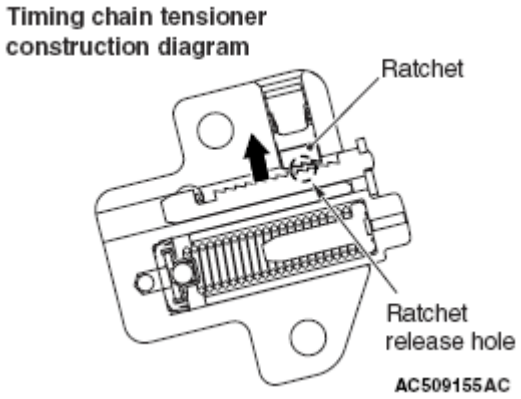


Fig. 31: Timing Chain Tensioner Construction Diagram
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION:
- **When inserting special tool MB992103 into the timing chain case assembly inside, pay attention to the position of the timing chain to avoid damage to the 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 1 again to unlock the timing chain tensioner and insert the special tool.**

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

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

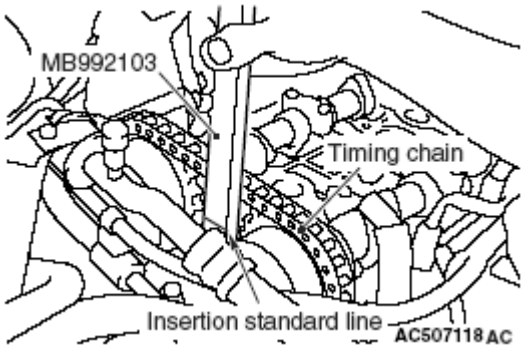


Fig. 32: Inserting Special Tool Of Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

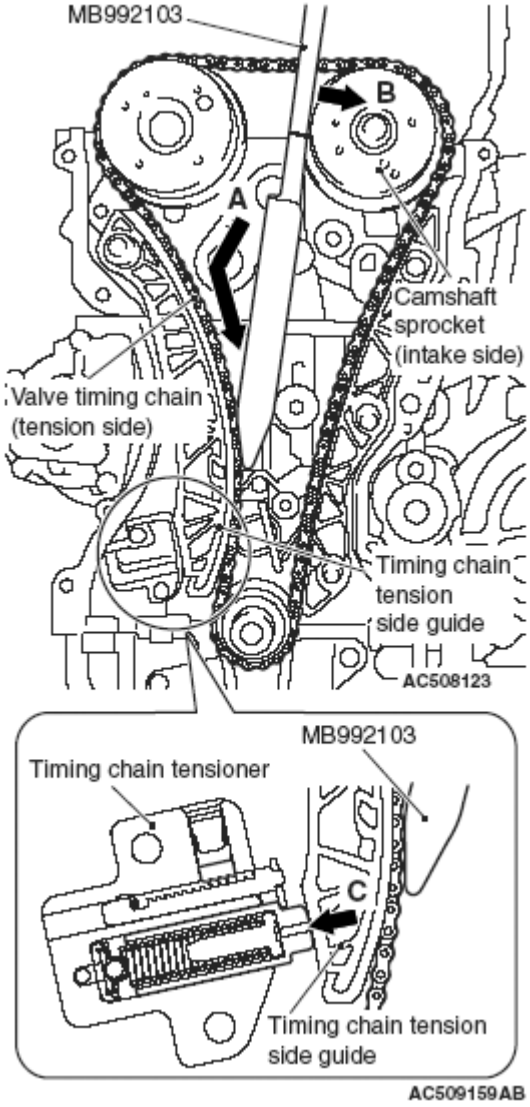


Fig. 33: Holding Timing Chain Tension Side Guide
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: The timing chain may snag on by other parts. After sagging the 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 timing chain between

the camshaft sprockets.

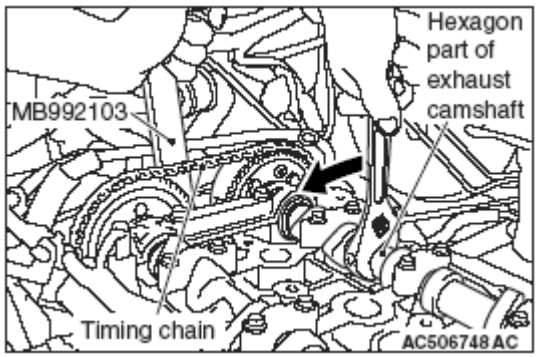


Fig. 34: Turning Camshaft Clockwise To Timing Chain Between Camshaft Sprockets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< D >> FRONT CAMSHAFT BEARING CAP ASSEMBLY REMOVAL

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

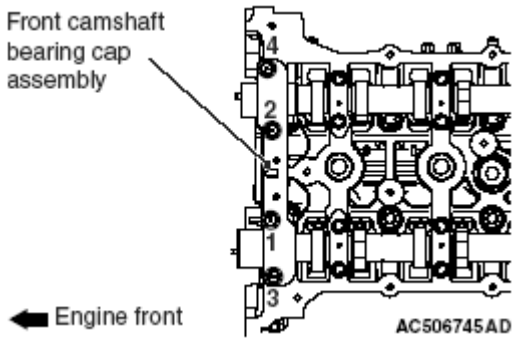


Fig. 35: Identifying Front Camshaft Bearing Cap Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< E >> OIL FEEDING CAMSHAFT BEARING CAP/CAMSHAFT BEARING CAP/THRUST CAMSHAFT BEARING 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 mounting bolts of the camshaft bearing caps in the order of number shown in the figure in four or five steps, and remove the camshaft bearing caps.

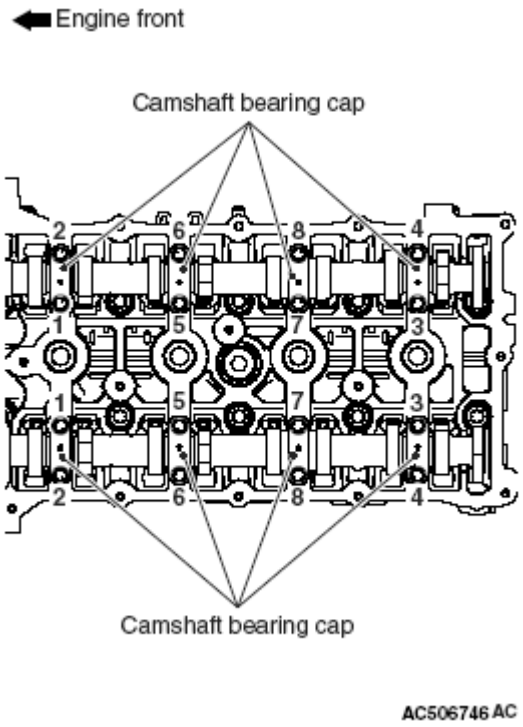


Fig. 36: Identifying Camshaft Bearing Caps
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< 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 timing chain, and remove from the cam bearing.

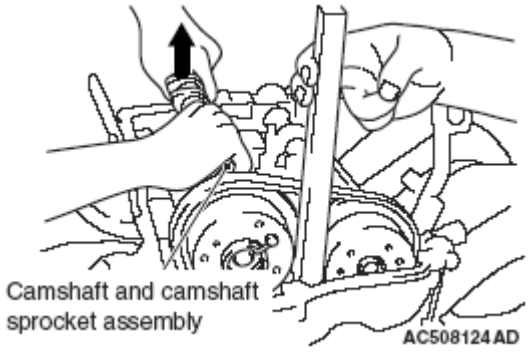


Fig. 37: Removing Camshaft And Camshaft Sprocket Assembly (Exhaust Side)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the 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.

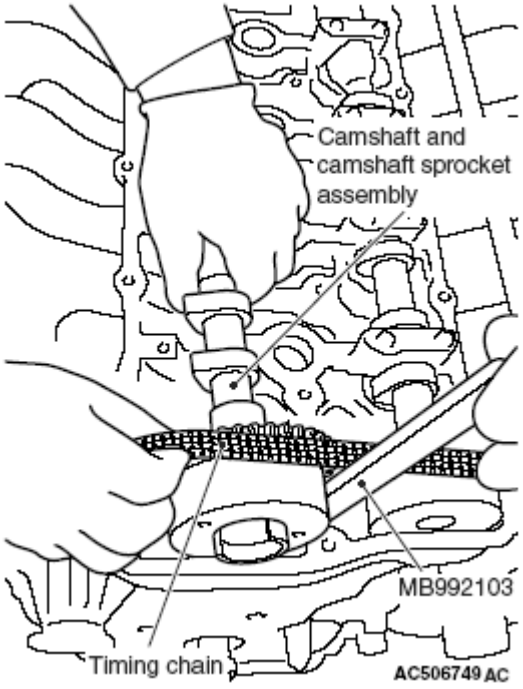


Fig. 38: Identifying Timing Chain, Camshaft And Camshaft Sprocket Assembly (Exhaust Side)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: The timing chain may snag on 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 timing chain with a rope to prevent the timing chain from falling into the timing chain case assembly.

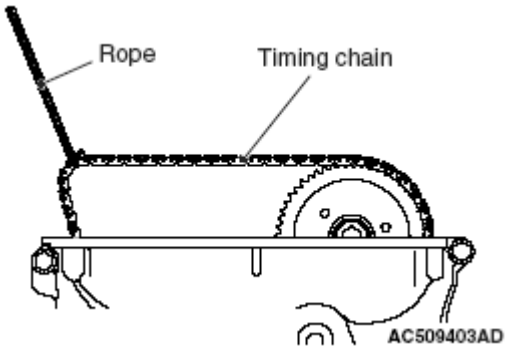


Fig. 39: Identifying Timing Chain And Rope
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< G >> CAMSHAFT SPROCKET/CAMSHAFT REMOVAL

Hold the flats of the camshaft with a monkey wrench. Loosen the camshaft sprocket mounting bolts and remove the camshaft sprocket from the camshaft.

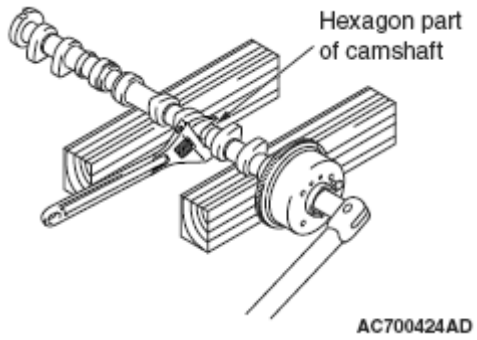


Fig. 40: Removing Camshaft Sprocket And Camshaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< H >> POWER STEERING OIL PUMP ASSEMBLY REMOVAL

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

<< I >> 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 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 flats of the camshaft in the same manner as removal.

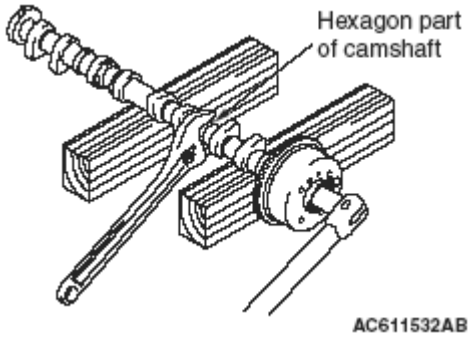


Fig. 41: Identifying Hexagon Part Of Camshaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Apply an adequate and minimum amount of engine oil to the camshaft and camshaft sprocket as shown in the figure.
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 bolts to the specified torque.

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

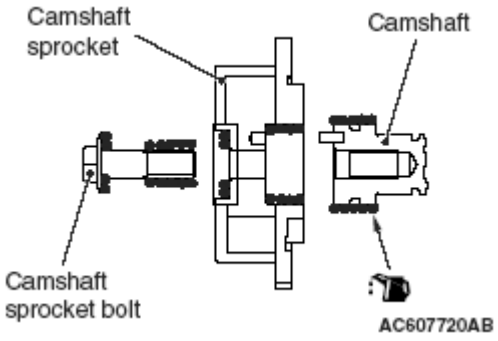


Fig. 42: Identifying Camshaft Sprocket Bolt, Camshaft Sprocket And Camshaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

1. Align the intake side paint mark of the timing chain which was put at removal with the paint mark of the intake side camshaft sprocket, and install the camshaft sprocket to the timing chain.
2. Install the camshaft and camshaft sprocket assembly (intake side) to the cylinder head.

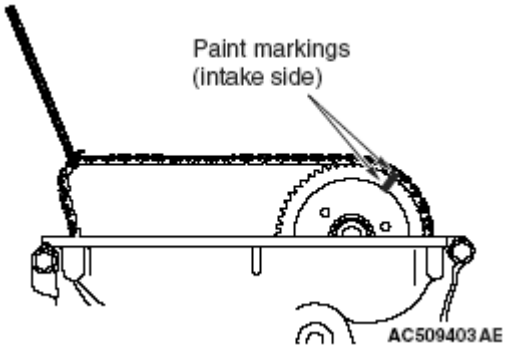


Fig. 43: Identifying Paint Mark Of Intake Side Camshaft Sprocket And Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

NOTE: Because the thrust camshaft bearing 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 bolt to the specified torque in the order of number shown in the figure in two or three steps.

Tightening torque: 12 ± 1 N.m (107 ± 8 in-lb)

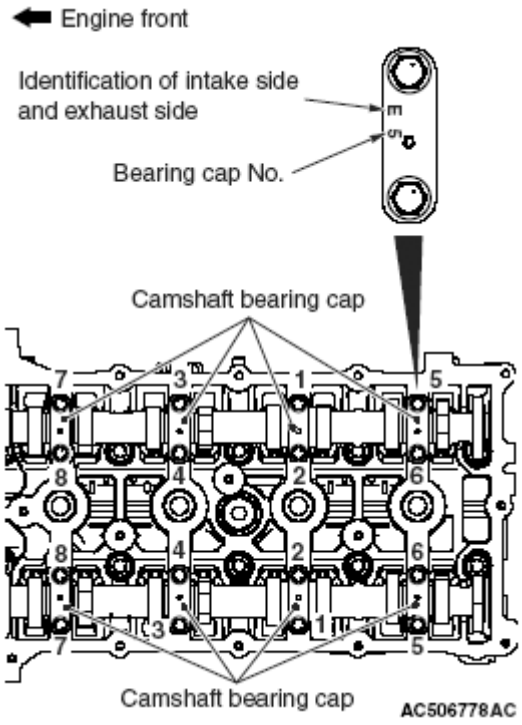


Fig. 44: Identifying Camshaft Bearing Caps To Cylinder Heads
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

CAUTION: Be careful not to drop the camshaft bearing.

1. When replacing the camshaft bearing, according to the identification mark of front camshaft bearing cap in the table below, select a camshaft bearing with the corresponding size. Note that the identification mark of camshaft bearing is stamped.

CAMSHAFT BEARING SPECIFICATION

Front Camshaft Bearing Cap		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

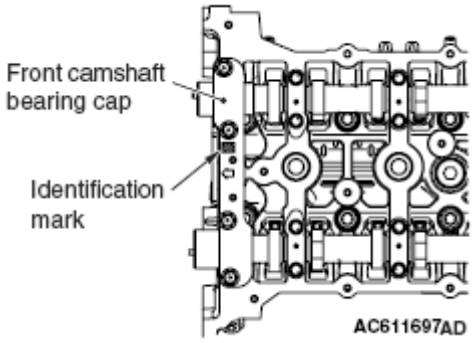


Fig. 45: Identifying Identification Mark Of Camshaft Bearing
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

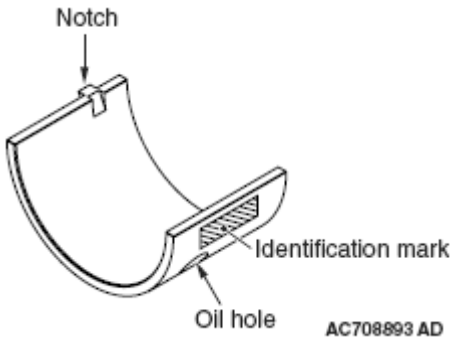


Fig. 46: Identifying Notch, Identification Mark And Oil Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. In the same manner as removal, insert the precision flat-tipped screwdriver through the service hole of the timing chain case, 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.

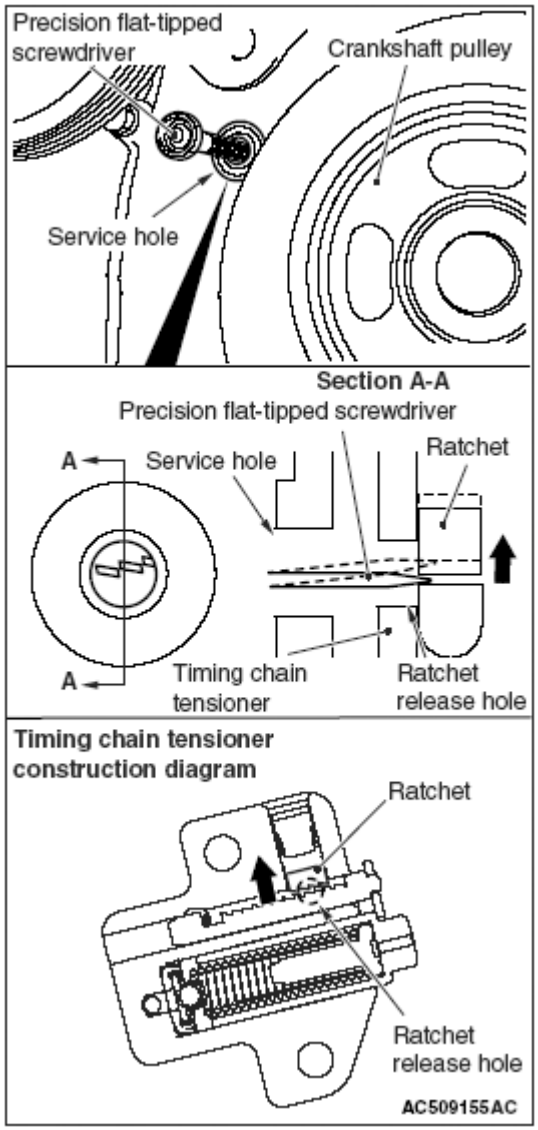


Fig. 47: Timing Chain Tensioner Construction Diagram
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION:

- **When inserting special tool MB992103 into the timing chain case assembly, pay attention to the position of the timing chain to avoid damage to the 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 inside the timing chain case

assembly along the tension side of the timing chain until the insertion guide line aligns with the upper surface of the timing chain case assembly (Figure A).

NOTE: With the timing chain tensioner unlocked, insert the special tool along the tension side of the 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.

4. With the special tool inserted up to the insertion guide line, press the special tool against the intake side camshaft sprocket (Figure B) and spread and hold the timing chain tension side guide (Figure C).
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 timing chain (Figure D) to provide allowance for easy installation of the camshaft and camshaft sprocket assembly (exhaust side) to the timing chain.

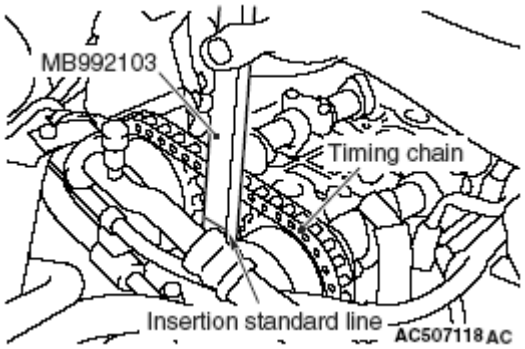


Fig. 48: Inserting Special Tool Of Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

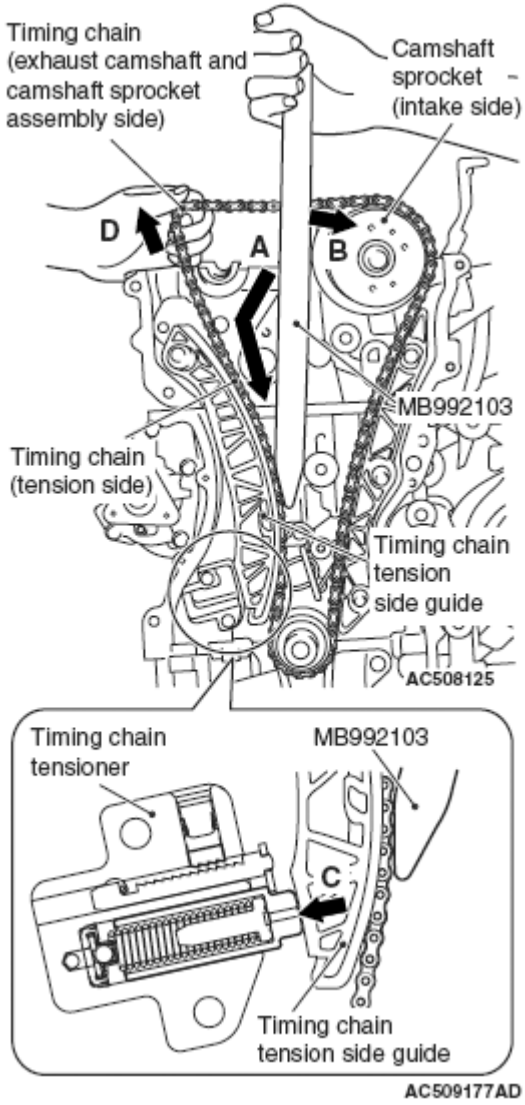


Fig. 49: Pulling Camshaft And Camshaft Sprocket Assembly (Exhaust Side)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 timing chain which was put at removal with the paint mark of the exhaust side camshaft sprocket, and install the 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.

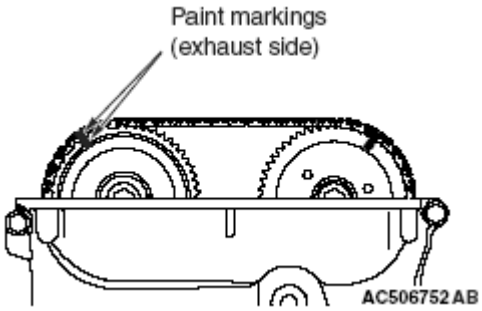


Fig. 50: Identifying Exhaust Side Paint Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> F << FRONT CAMSHAFT BEARING CAP ASSEMBLY INSTALLATION

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

1. Install the front camshaft bearing cap to the cylinder head, and temporarily tighten the camshaft bearing front cap to the specified torque in the order of the figure (1).

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

2. Tighten the front camshaft bearing cap again to the specified torque in the order of the figure (2).

   Tightening torque: 30 ± 2 N.m (23 ± 1 ft-lb)

3. After the front camshaft bearing 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.

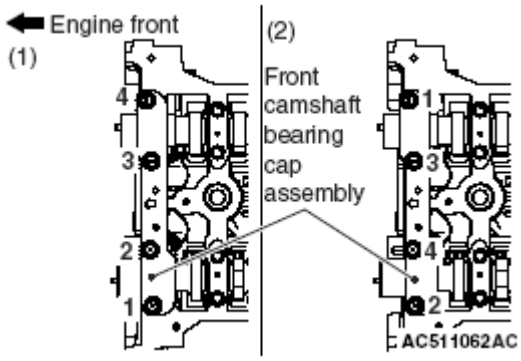


Fig. 51: Identifying Front Camshaft Bearing Cap Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> G << ROCKER COVER ASSEMBLY INSTALLATION

1. Wipe off the sealant on the mating surface of the rocker cover assembly and the cylinder head and timing chain case assembly, and degrease the surface where the sealant is applied by white gasoline or the like.
2. Apply sealant to the joint between the cylinder head and timing chain case assembly as shown in the figure and install the rocker cover assembly to the cylinder head.

   Specified sealant: Three bond 1217G or equivalent

   NOTE: Install the rocker cover assembly within 3 minutes after the application of sealant.

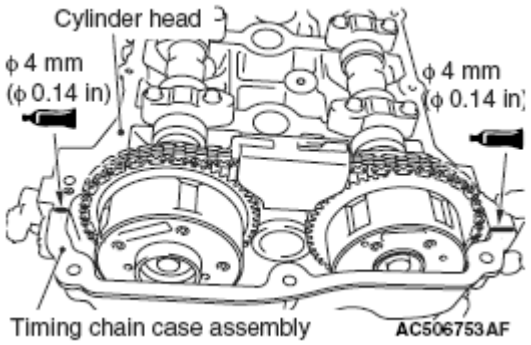


Fig. 52: Applying Sealant To Joint Between Cylinder Head And Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   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 figure.

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

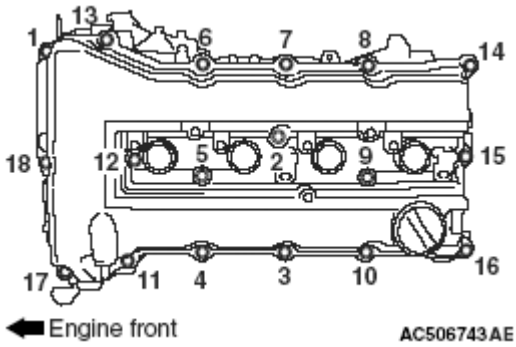


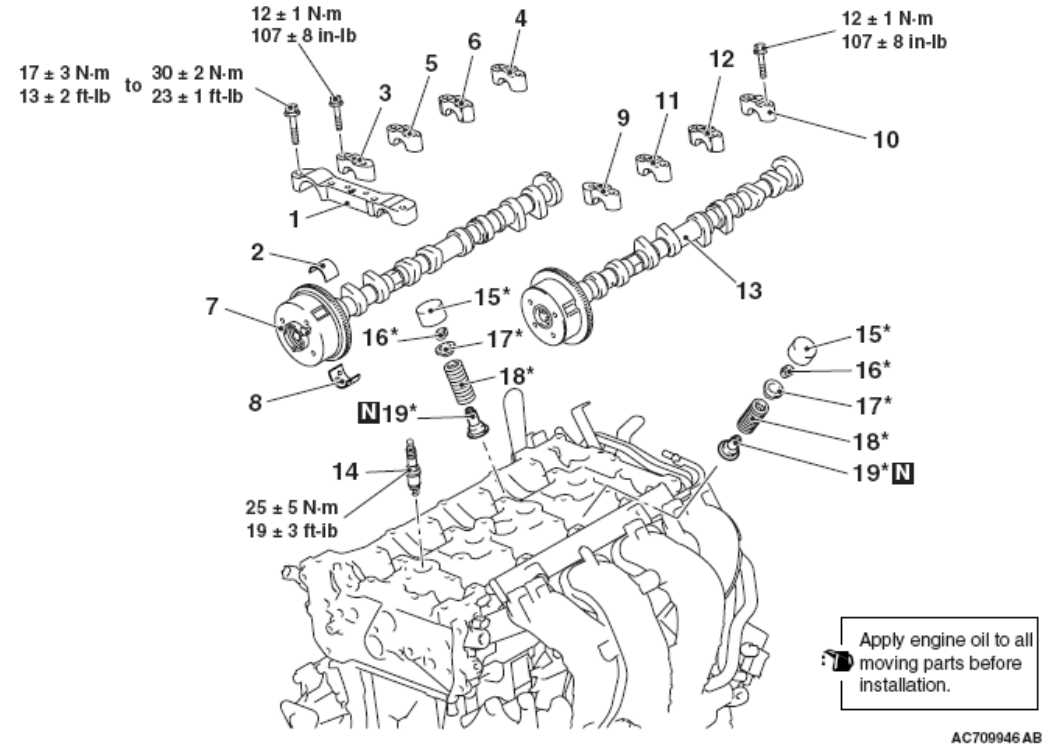
Fig. 53: Identifying Rocker Cover Assembly Mounting Bolts Tighten Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

VALVE STEM SEAL

REMOVAL AND INSTALLATION

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

Pre-removal operation	Post-installation operation
• Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal • Engine Oil Draining • Rocker Cover Assembly Removal • Engine Oil Pan Removal • Timing Chain Removal	• Timing Chain Installation • Engine Oil Pan Installation • Valve Clearance Check • Rocker Cover Assembly Installation • Engine Oil Refilling • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation



			Removal steps
<<A>>	>>F<<	1.	Front camshaft bearing cap assembly
	>>E<<	2.	Camshaft bearing
<<B>>	>>D<<	3.	Oil feeding camshaft bearing cap (exhaust side)
<<B>>	>>D<<	4.	Camshaft bearing cap (exhaust side)
<<B>>	>>D<<	5.	Camshaft bearing cap (exhaust side)
			Removal steps (Continued)
<<B>>	>>D<<	12.	Thrust camshaft bearing cap (intake side)
		13.	Camshaft and camshaft sprocket assembly (intake side)
		14.	Spark plug
<<C>>	>>C<<	15.	Valve tappet
<<D>>	>>B<<	16.	Valve spring retainer lock
		17.	Valve spring retainer
		18.	Valve spring
<<E>>	>>A<<	19.	Valve stem seal
			Removal steps (Continued)
<<B>>	>>D<<	6.	Thrust camshaft bearing cap (exhaust side)
	>>E<<	7.	Camshaft and camshaft sprocket assembly (exhaust side)
	>>E<<	8.	Camshaft bearing
<<B>>	>>D<<	9.	Oil feeding camshaft bearing cap (intake side)
<<B>>	>>D<<	10.	Camshaft bearing cap (intake side)
<<B>>	>>D<<	11.	Camshaft bearing cap (intake side)

Fig. 54: Identifying Valve Stem Parts 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 >> FRONT CAMSHAFT BEARING CAP ASSEMBLY REMOVAL

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

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 engine hanger (MB991928 or MB991895) which was installed for supporting the engine and transaxle assembly when the valve timing chain was removed.

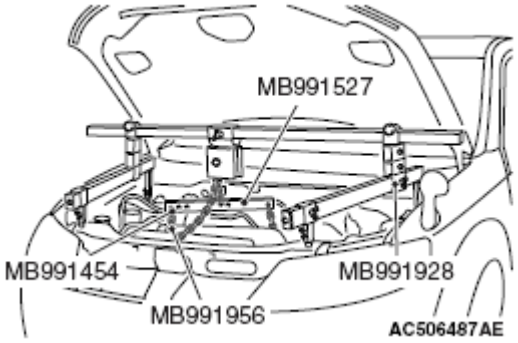


Fig. 55: Identifying Special Tool Engine Hanger (MB991928 Or MB991956)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

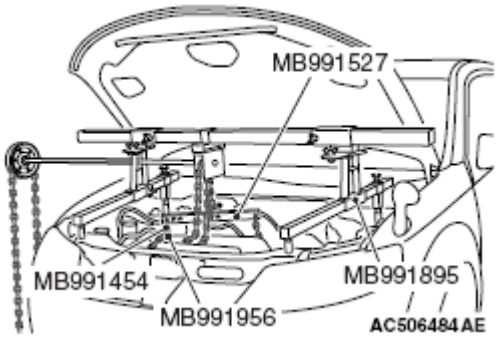


Fig. 56: Identifying Special Tool Engine Hanger (MB991454 Or MB991995)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Be careful not to drop the camshaft bearing.

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

<< B >> OIL FEEDING CAMSHAFT BEARING CAP/CAMSHAFT BEARING CAP/THRUST CAMSHAFT BEARING 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 mounting bolts of the camshaft bearing caps in the order of number shown in the figure in four or five steps, and remove the camshaft bearing caps.

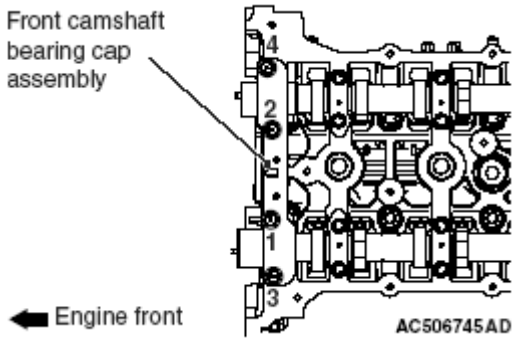


Fig. 57: Identifying Front Camshaft Bearing Cap Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

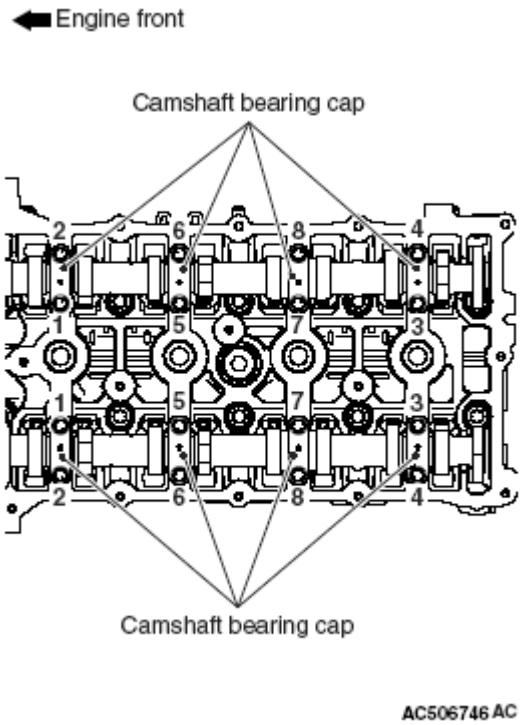


Fig. 58: Identifying Camshaft Bearing Caps
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< C >> VALVE TAPPET REMOVAL

CAUTION:
- **Do not use pliers or other tools to remove the valve tappets. Always remove them by hand.**
- **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 hand.

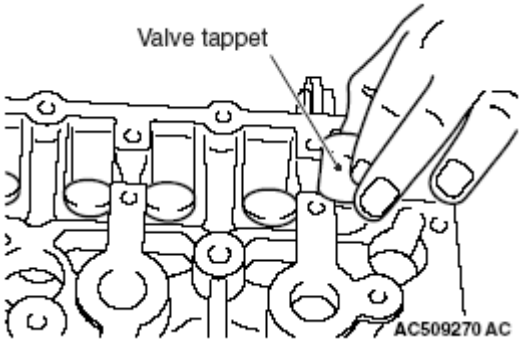


Fig. 59: Removing Valve Tappets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< 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.

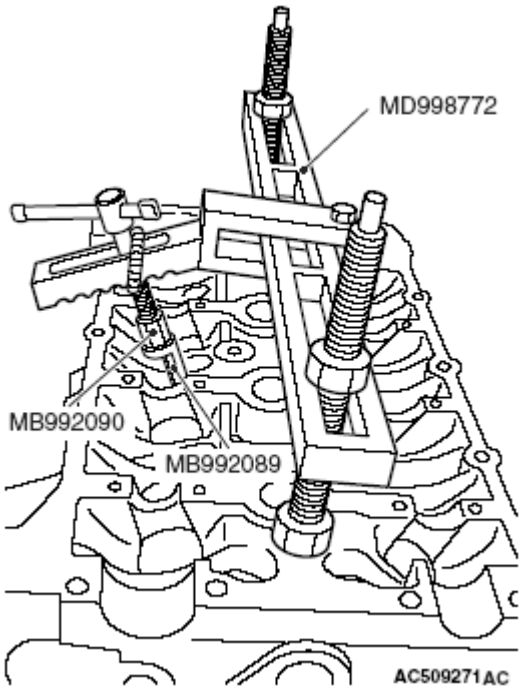


Fig. 60: Identifying Special Tool MB992090 And Special Tool MD998772
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< 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.

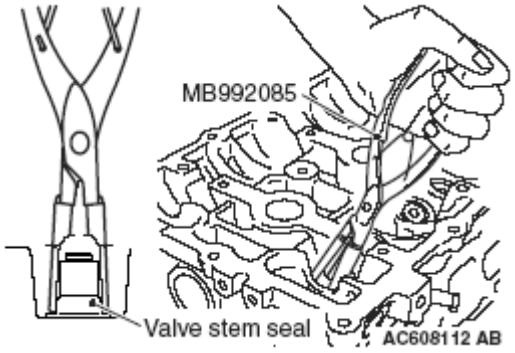


Fig. 61: Removing Valve Stem Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

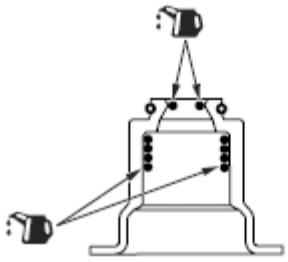


Fig. 62: Identifying Press-fit Part And Lip Part Of Valve Stem Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

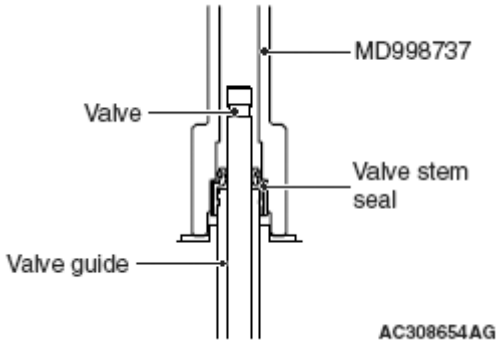


Fig. 63: Identifying Special Tool MD998737
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << VALVE SPRING RETAINER LOCK INSTALLATION

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

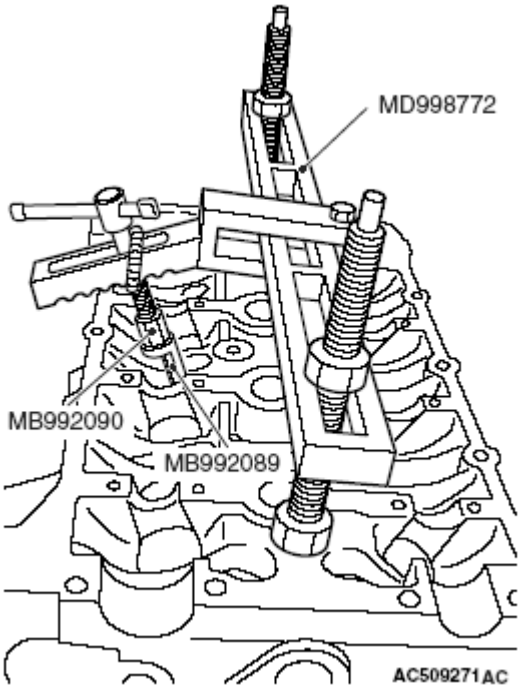


Fig. 64: Identifying Special Tool MD998772, Special Tool MB992090 And Special Tool MB992089
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << VALVE TAPPET INSTALLATION

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

CAUTION: Be sure to install the valve tappets in the same position as before.

2. Install the valve tappet to the cylinder head.

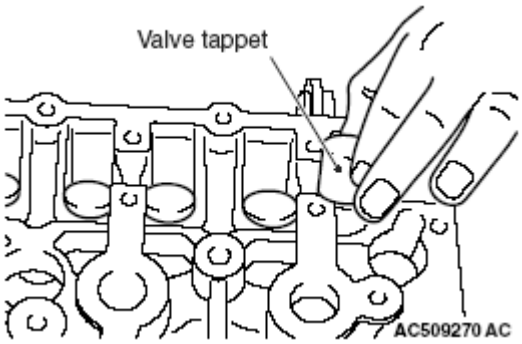


Fig. 65: Removing Valve Tappets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

NOTE: Because the thrust camshaft bearing 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 to the specified torque in the order of number shown in the figure in two or three steps.

Tightening torque: 12 ± 1 N.m (107 ± 8 in-lb)

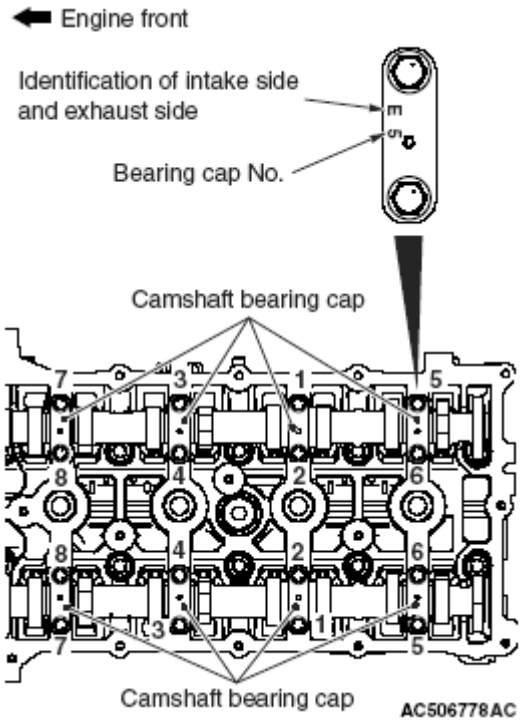


Fig. 66: Identifying Camshaft Bearing Caps To Cylinder Heads
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> 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, according to the identification mark of front camshaft bearing cap in the table below, select a camshaft bearing with the corresponding size. Note that the identification mark of camshaft bearing is stamped on the place shown in the figure.

CAMSHAFT BEARING SPECIFICATION

Front Camshaft Bearing Cap		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

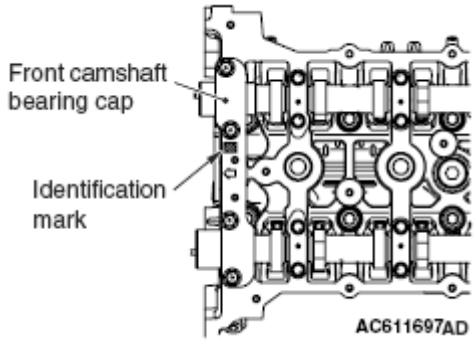


Fig. 67: Identifying Identification Mark Of Camshaft Bearing
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

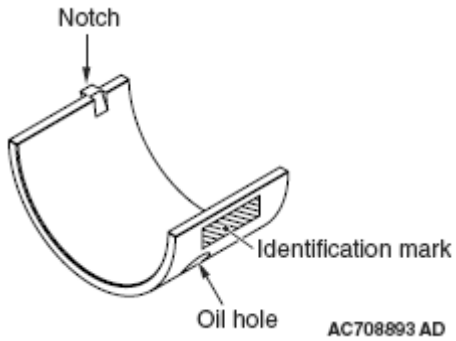


Fig. 68: Identifying Notch, Identification Mark And Oil Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> F << FRONT CAMSHAFT BEARING CAP ASSEMBLY INSTALLATION

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

1. Install the front camshaft bearing cap to the cylinder head, and temporarily tighten the front camshaft bearing cap to the specified torque in the order of the figure (1).

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

2. Tighten the front camshaft bearing cap again to the specified torque in the order of the figure (2).

   Tightening torque: 30 ± 2 N.m (23 ± 1 ft-lb)

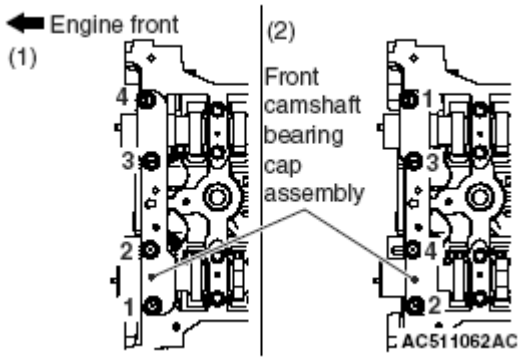


Fig. 69: Identifying Front Camshaft Bearing Cap Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

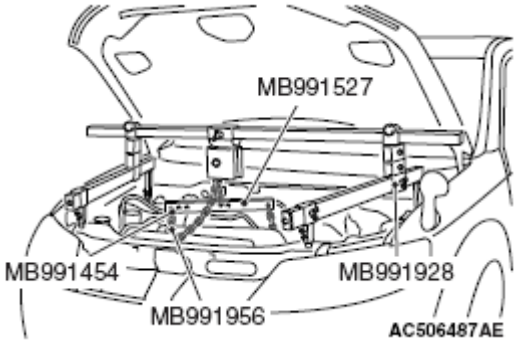


Fig. 70: Identifying Special Tool Engine Hanger (MB991928 Or MB991956)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

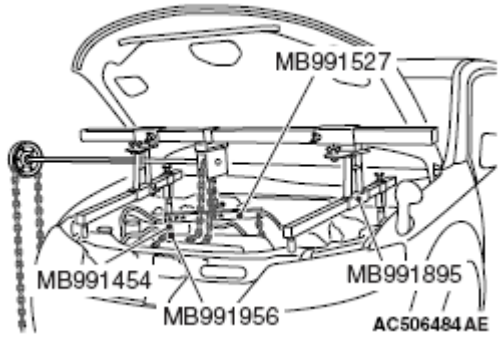
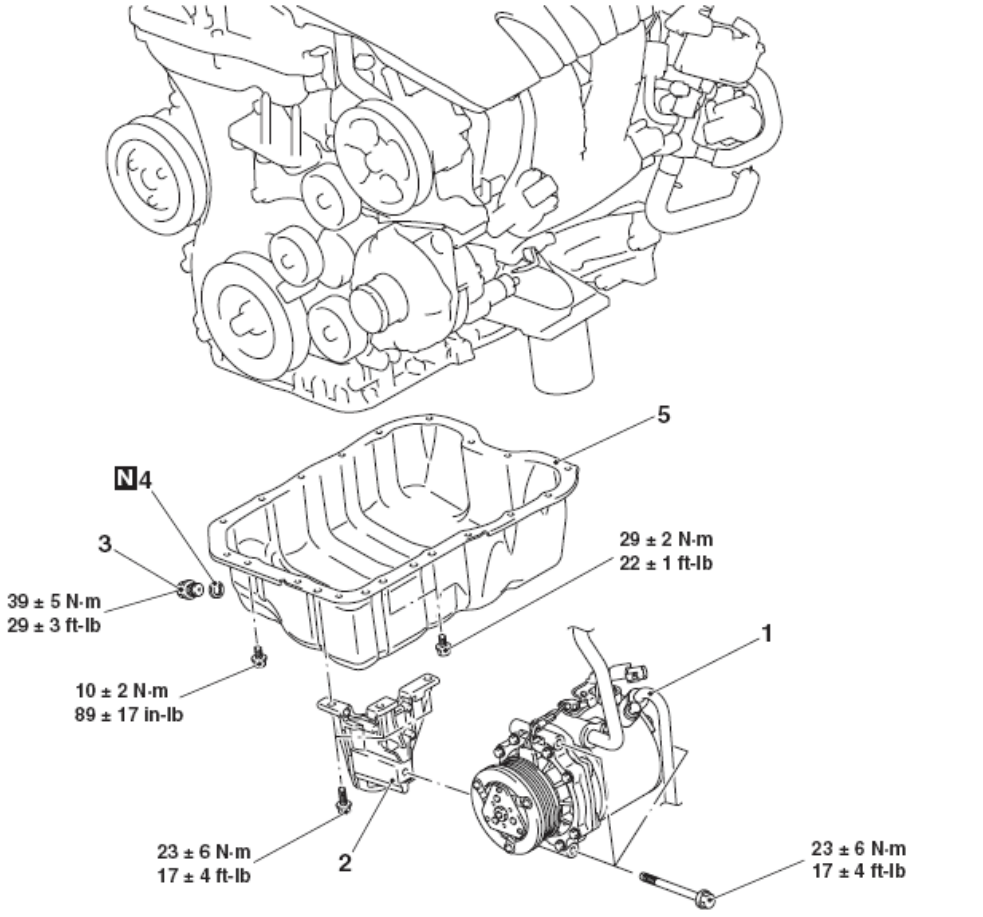


Fig. 71: Identifying Special Tool Engine Hanger (MB991454 Or MB991995)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal operation	Post-installation operation
• Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal • Engine Oil Draining • Drive Belt Removal	• Drive Belt Installation • Engine Oil Refilling • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation



		Removal steps			Removal steps (Continued)
<<A>>	>>C<<	1. A/C compressor and clutch assembly		3.	Engine oil pan drain plug
		2. A/C compressor bracket	>>B<<	4.	Engine oil pan drain plug gasket
			<<B>> >>A<<	5.	Engine oil pan

Fig. 72: Identifying Oil Pan Parts With Torque Specification
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 special tool MD998727 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 oil pan seal surface, cut off the liquid gasket, and remove the engine oil pan.

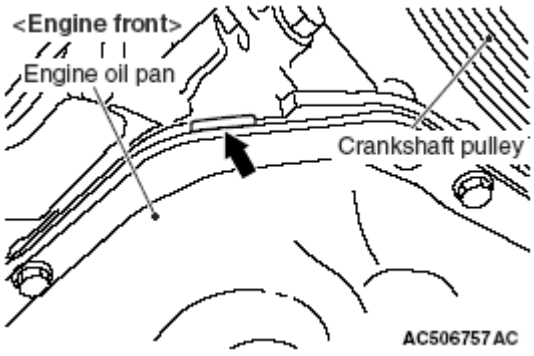


Fig. 73: Identifying Engine Oil Pan And Crankshaft Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

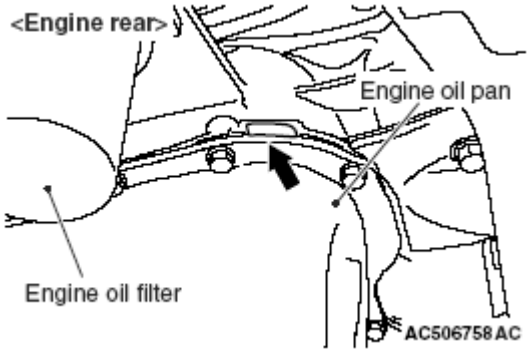


Fig. 74: Identifying Engine Oil Filter And Engine Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

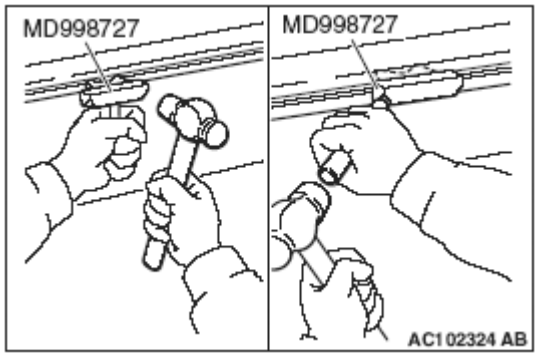


Fig. 75: Inserting Special Tool MD998727 From Engine Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << ENGINE OIL PAN INSTALLATION

1. Remove all the traces of sealant adhering to the engine oil pan and cylinder block assembly using a remover or others. Then, degrease them using white gasoline.
2. Apply the sealant without any gap to the mating surface of engine oil pan as shown in the figure. Within three minutes, install the engine oil pan to the cylinder block assembly.

   Specified sealant: Three bond 1217G or equivalent

   CAUTION: Do not apply oil or water to the sealant-applied area or start up the engine within 2 hours after the installation of the engine oil pan.

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 (22 ± 1 ft-lb)

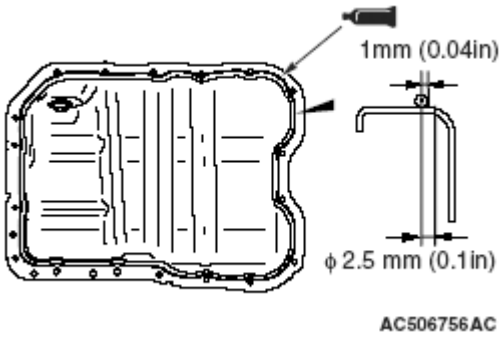


Fig. 76: Applying Sealant Without Any Gap To Mating Surface Of Engine Oil Pan

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.

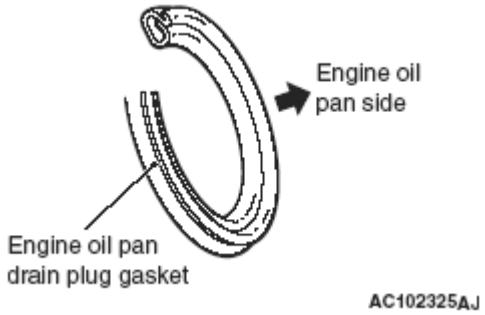


Fig. 77: Installing Engine Oil Pan Drain Plug Gasket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Tighten A/C compressor and clutch assembly mounting bolts to the specified torque in the order of number shown in the illustration.

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

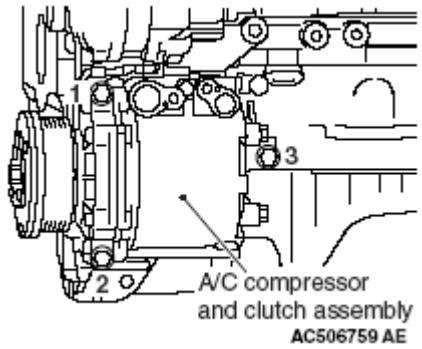


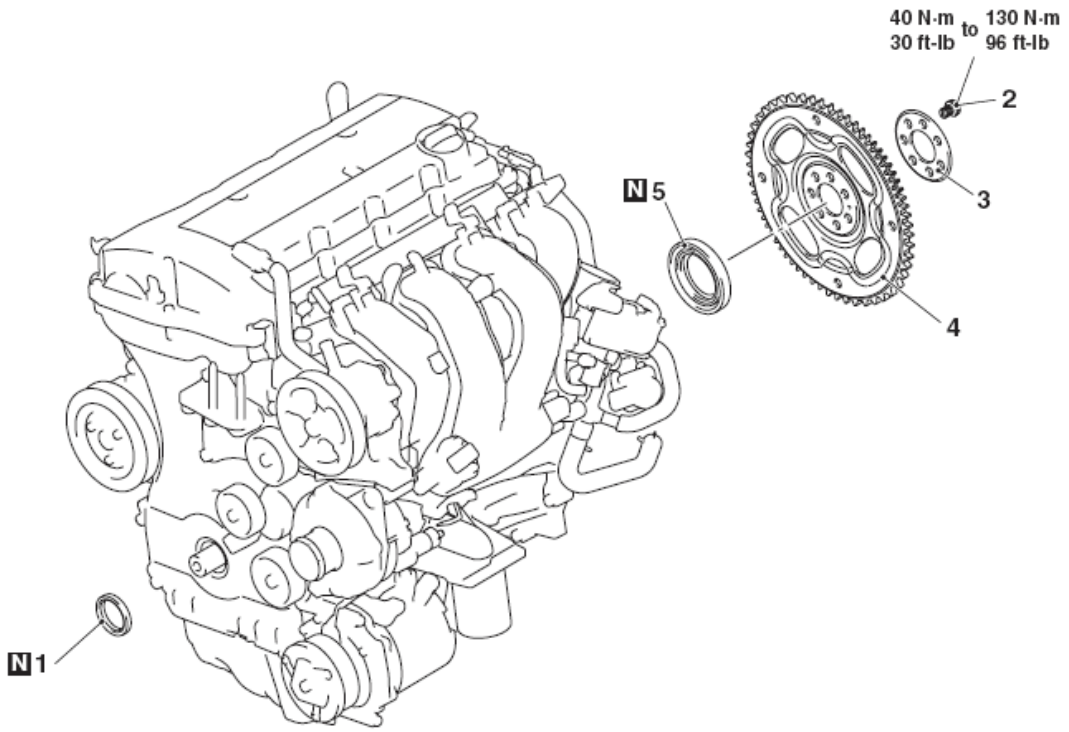
Fig. 78: Identifying A/C Compressor And Clutch Assembly Mounting Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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



Crankshaft front oil seal removal steps

- Crankshaft pulley

>>C<< 1. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

- Transaxle assembly

<<A>> >>B<< 2. Drive plate bolts
>>B<< 3. Adapter plate
>>B<< 4. Drive plate
>>A<< 5. Crankshaft rear oil seal

Fig. 79: Identifying Crankshaft Oil Seal 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 >> DRIVE PLATE BOLTS REMOVAL

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

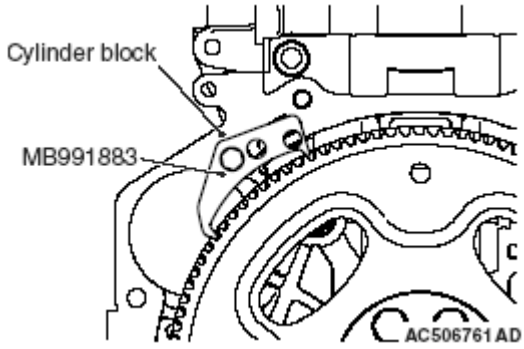


Fig. 80: Identifying Special Tool MB991883 And Cylinder Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << CRANKSHAFT REAR OIL SEAL INSTALLATION

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

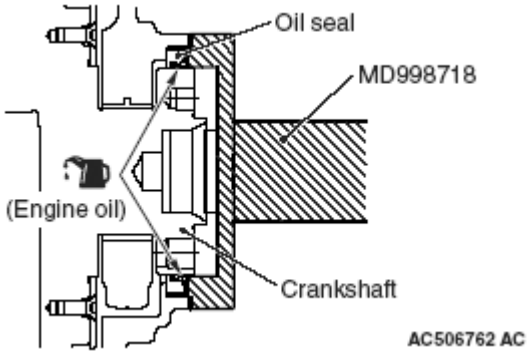


Fig. 81: Installing Crankshaft Rear Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << DRIVE PLATE/ADAPTER PLATE/DRIVE PLATE BOLTS INSTALLATION

1. Remove the sealant, the engine oil, and other adhering materials from the drive plate and adapter plate installation face, the crankshaft screw hole and drive plate bolts.
2. Install the drive plate and adapter plate to the crankshaft.
3. Use special tool MB991883 to secure the drive plate and adapter plate in the same manner as removal.
4. Apply a small amount of engine oil to the screw holes of the crankshaft and the bearing surface of the drive plate bolts and the adapter plate bolts.

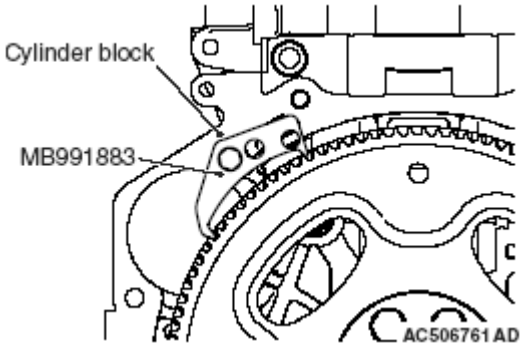


Fig. 82: Identifying Special Tool MB991883 And Cylinder Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Apply sealant to the thread of the drive plate bolts and the flywheel bolts.

   Specified sealant: Three bond 1324 or equivalent

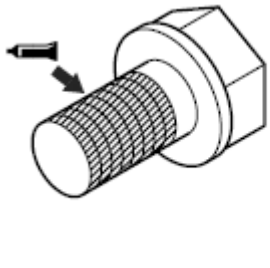


Fig. 83: Applying Sealant To Thread Of Drive Plate Bolts And Flywheel Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Tighten drive plate bolts to temporary torque 40 N.m (30 ft-lb) in the order shown in the illustration.
7. Tighten drive plate bolts to specified torque in the order shown in the illustration.

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

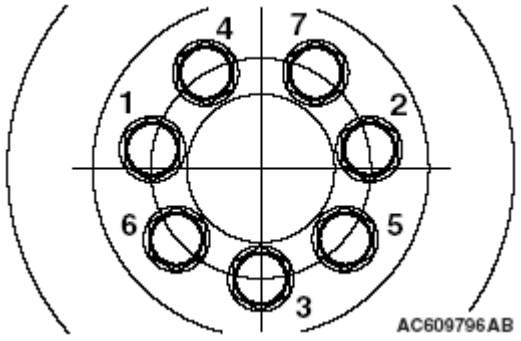


Fig. 84: Identifying Drive Plate Bolts Tighten Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

CAUTION: When installing the crankshaft 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.

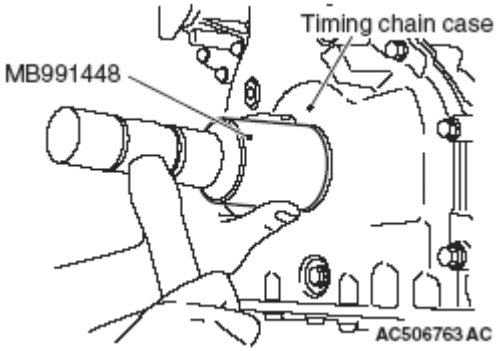
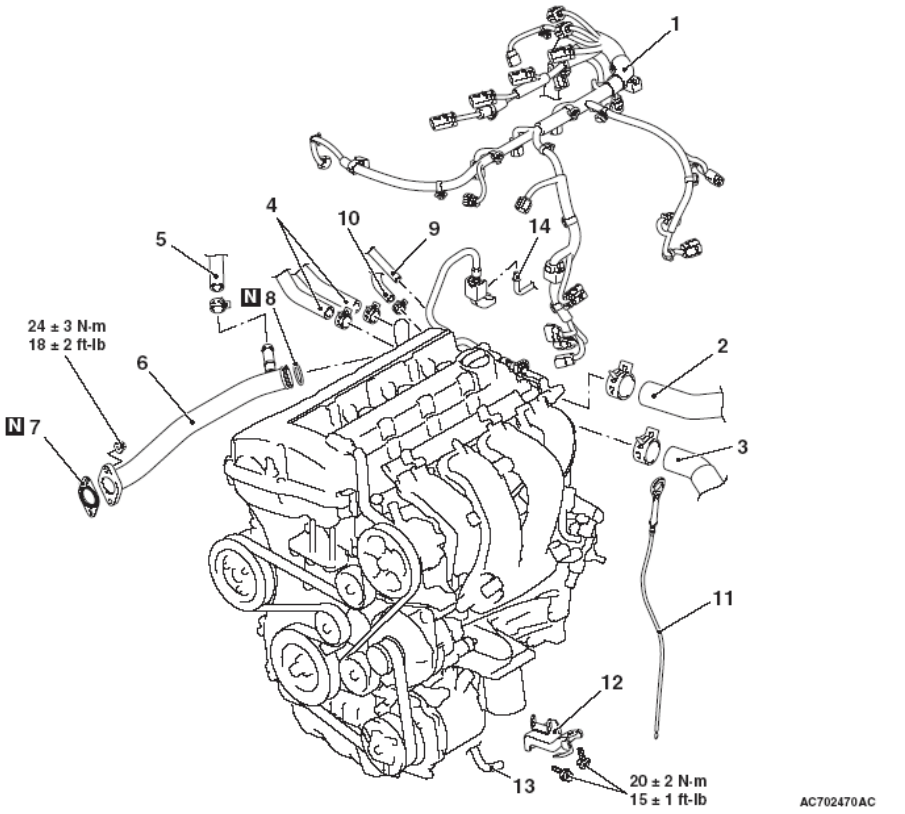


Fig. 85: Installing Crankshaft Front Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal operation	Post-installation operation
• Fuel Line Pressure Reduction	• Water Pump Installation
• Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal	• EGR Valve and EGR Valve Stay Installation
• Engine Coolant Draining	• Throttle Body Assembly Installation
• Air Cleaner Assembly Removal	• Exhaust Manifold Installation
• Ignition Coil Removal	• Strut Tower Bar Installation
• Strut Tower Bar Removal	• Ignition Coil Installation
• Exhaust Manifold Removal	• Air Cleaner Assembly Installation
• Throttle Body Assembly Removal	• Engine Coolant Refilling
• EGR Valve and EGR Valve Stay Removal	• Fuel Leak Check • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation
• Water Pump Removal	

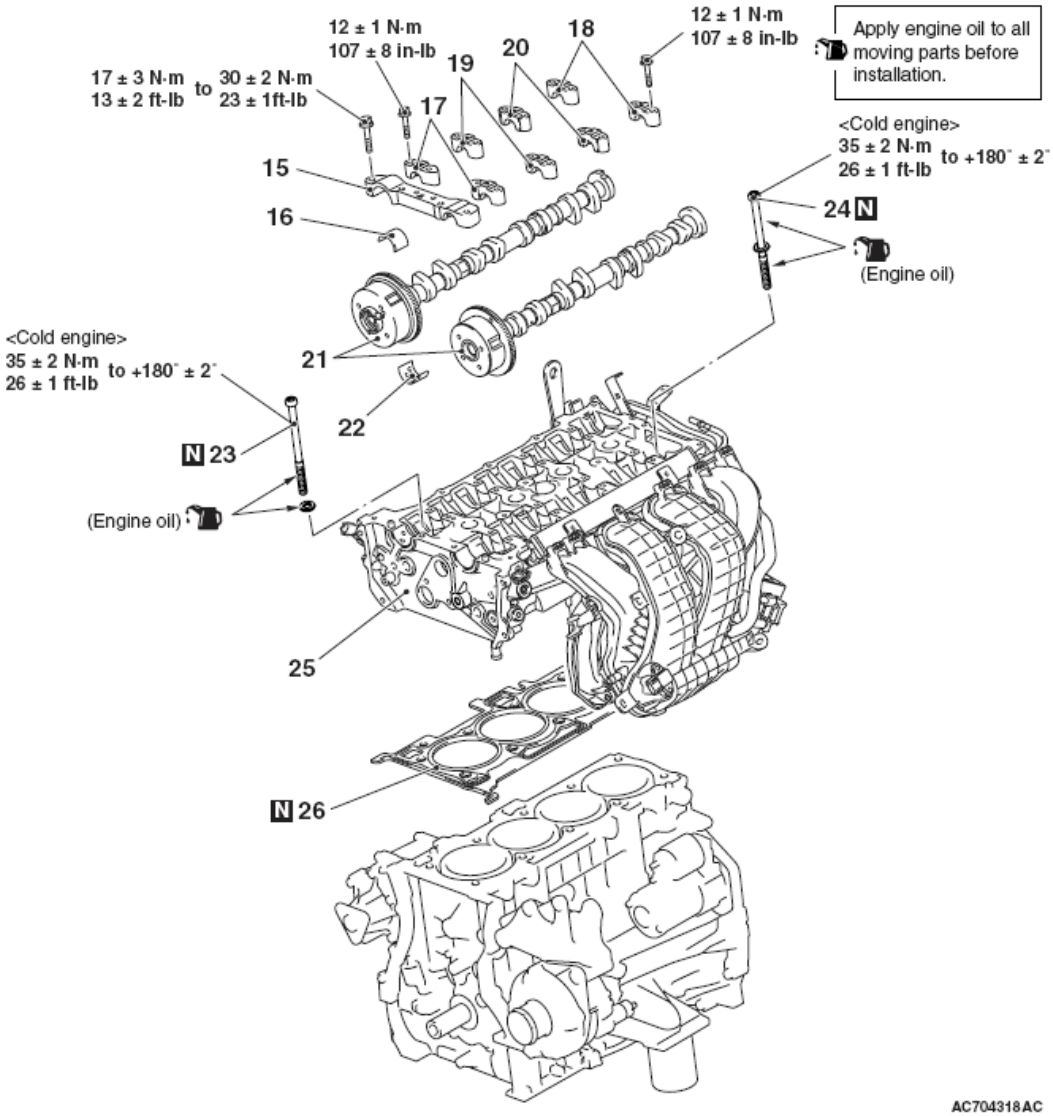


Removal steps
1. Control wiring harness connection
2. Radiator upper hose connection
3. Radiator lower hose connection
4. Heater hose connection
5. CVT fluid cooler water return hose B connection
6. Water pump intake pipe
7. Cooling water line gasket
8. O-ring

Removal steps (Continued)
9. Canister vacuum hose connection
10. Brake booster vacuum hose connection
11. Engine oil level gauge
12. Intake manifold stay
13. Rocker cover PCV hose connection
14. Fuel high-pressure hose connection

<<A>> >>F<<

Fig. 86: Identifying Cylinder Head Gasket And Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



			Removal steps
		•	Valve timing chain
<<B>>	>>E<<	15.	Front camshaft bearing cap assembly
		16.	Camshaft bearing
<<C>>	>>D<<	17.	Oil feeding camshaft bearing cap
<<C>>	>>D<<	18.	Camshaft bearing cap
<<C>>	>>D<<	19.	Camshaft bearing cap

			Removal steps (Continued)
<<C>>	>>D<<	20.	Thrust camshaft bearing cap
	>>C<<	21.	Camshaft and camshaft sprocket assembly
		22.	Camshaft bearing
<<D>>	>>B<<	23.	Cylinder head bolt
<<D>>	>>B<<	24.	Cylinder head bolt assembly
	>>A<<	25.	Cylinder head assembly
	>>A<<	26.	Cylinder head gasket

Fig. 87: Identifying Cylinder Head Gasket And Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991895: Engine Hanger
- MB991928: Engine Hanger

REMOVAL SERVICE POINTS

<< A >> FUEL HIGH-PRESSURE HOSE REMOVAL

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

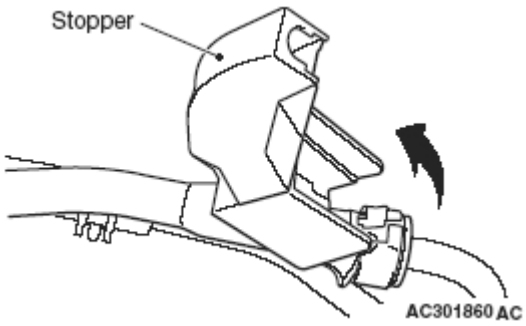


Fig. 88: Removing Stopper Of Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

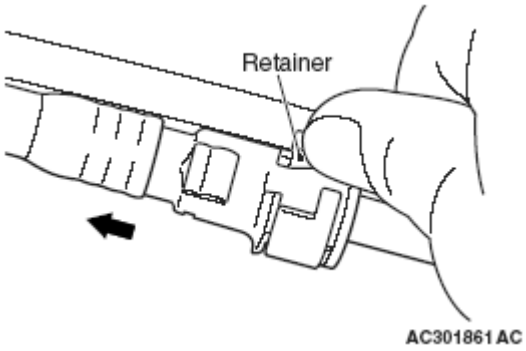


Fig. 89: Raising Retainer Of Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> FRONT CAMSHAFT BEARING CAP ASSEMBLY REMOVAL

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

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 engine hanger (MB991928 or MB991895) which was installed for supporting the engine and transaxle assembly when the valve timing chain was removed.

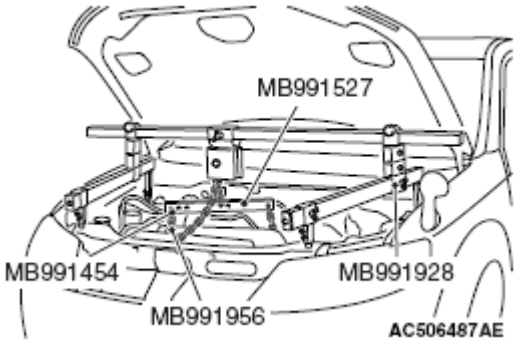


Fig. 90: Identifying Special Tool Engine Hanger (MB991928 Or MB991956)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

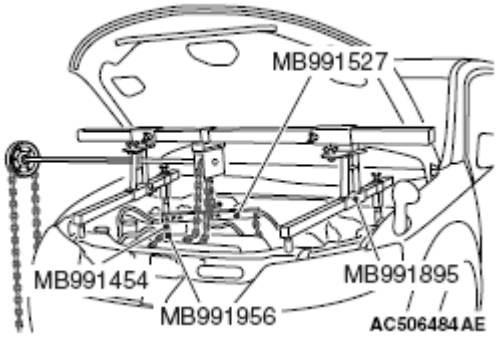


Fig. 91: Identifying Special Tool Engine Hanger (MB991454 Or MB991995)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Be careful not to drop the camshaft bearing.

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

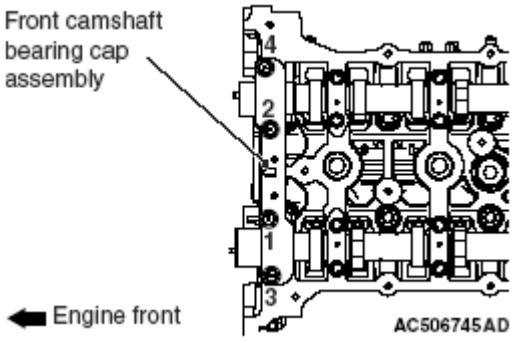


Fig. 92: Identifying Front Camshaft Bearing Cap Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< C >> OIL FEEDING CAMSHAFT BEARING CAP/CAMSHAFT BEARING CAP/THRUST CAMSHAFT BEARING 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 mounting bolts of the camshaft bearing caps in the order of number shown in the figure in four or five steps, and remove the camshaft bearing caps.

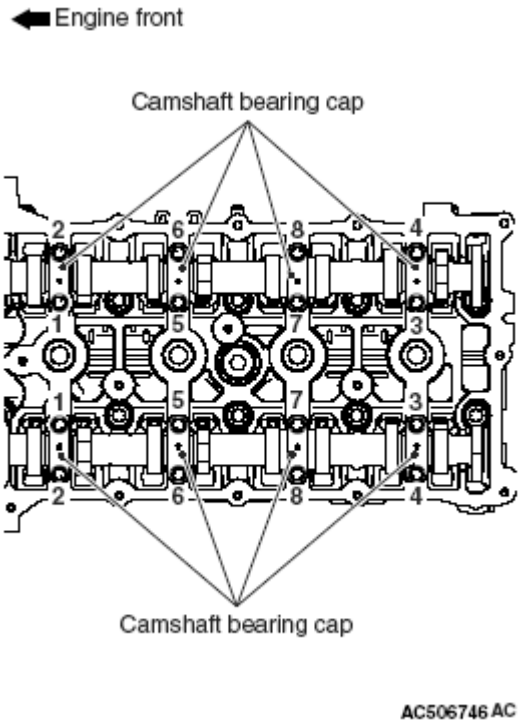


Fig. 93: Identifying Camshaft Bearing Caps
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< D >> 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 figure.

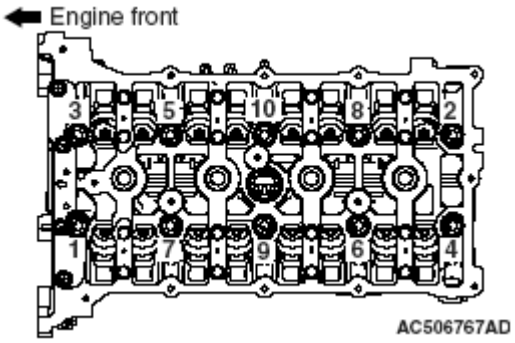


Fig. 94: Identifying Cylinder Head Bolt Loosen Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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. Remove the sealant and grease on the top surface of cylinder block and on the bottom surface of the cylinder head. Then, use the white gasoline to degrease the sealant application surface.

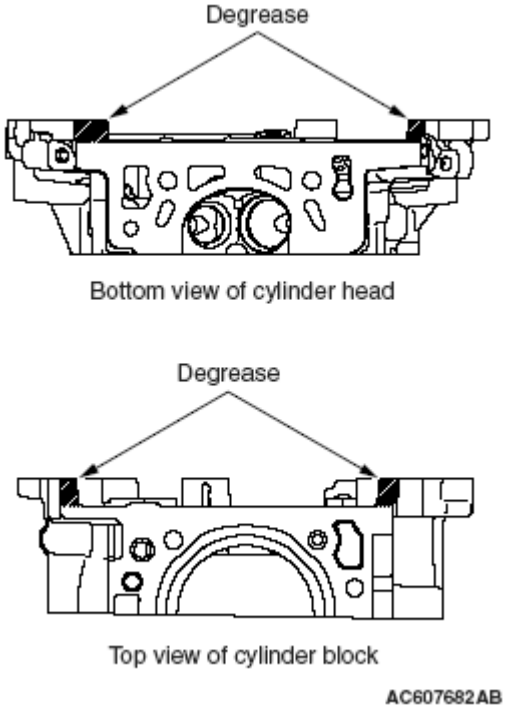


Fig. 95: Identifying Top Surface Of Cylinder Block And Bottom Surface Of Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   Specified sealant: Three bond 1217G

3. Within three minutes after the sealant application, install the cylinder head gasket to the cylinder block.

   NOTE: When the cylinder 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 cylinder head gasket as shown in the figure.

   Specified sealant: Three bond 1217G

   CAUTION: Within two hours after the cylinder head assembly installation, do not apply oil or water to the sealant application area or start the engine.

5. Within three minutes after the sealant application, install the cylinder head assembly.

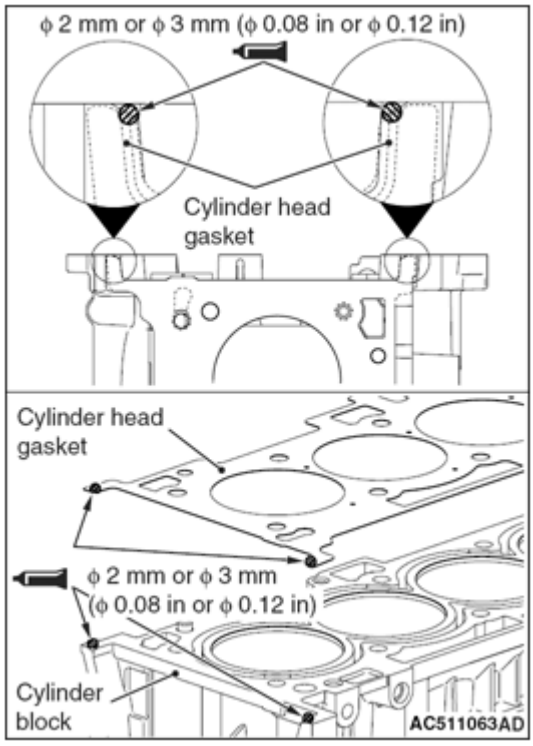


Fig. 96: Applying Sealant To Top Surface Of Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

1. Replace cylinder head bolts with a new ones.

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 bolts by the following procedure (plastic region angular tightening method).
    1. Tighten the bolts to 35 ± 2 N.m (26 ± 1 ft-lb) in the order number shown in the figure.

CAUTION:
- **The bolt is not tightened sufficiently if the tightening angle is less than a 180 degrees angle.**
- **If the tightening angle exceeds the standard specification, remove the bolt and repeat the installation steps from Step 1.**

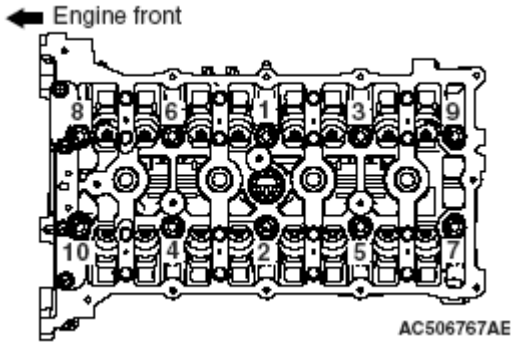


Fig. 97: Identifying Cylinder Head Bolt Tighten Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Put a paint mark on the cylinder head bolt head and cylinder head, tighten to 180 ± 2 degrees in the order shown in the figure, and check that the paint mark on the cylinder head bolt head aligns with the paint mark on the cylinder head.

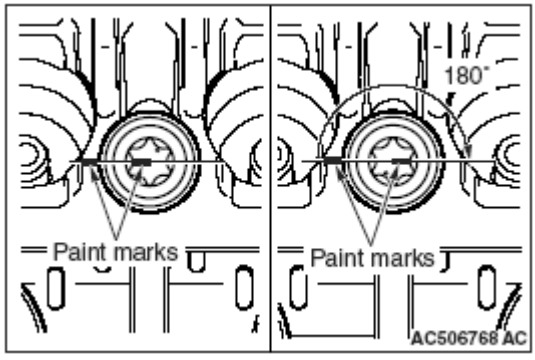


Fig. 98: Identifying Paint Mark On Cylinder Head Bolt Head And Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. 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 **TIMING CHAIN**).

6. Remove the garage jack which supports the engine and transaxle assembly.
7. Remove the engine oil pan installed temporarily.

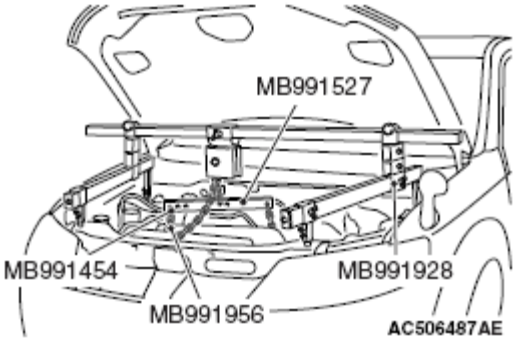


Fig. 99: Identifying Special Tool Engine Hanger (MB991928 Or MB991956)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

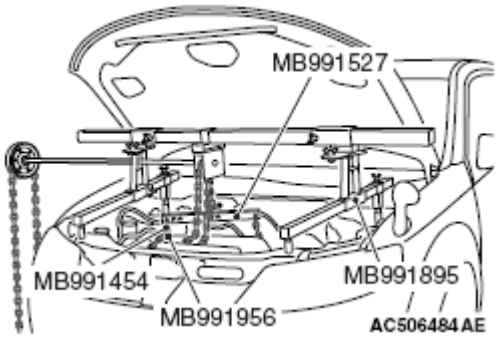


Fig. 100: Identifying Special Tool Engine Hanger (MB991454 Or MB991995)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << CAMSHAFT BEARING/CAMSHAFT AND CAMSHAFT SPROCKET ASSEMBLY 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, according to the identification mark of front camshaft bearing cap in the table below, select a camshaft bearing with the corresponding size. Note that the identification mark of camshaft bearing is stamped on the place shown in the figure.

CAMSHAFT BEARING SPECIFICATION

Front Camshaft Bearing Cap		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

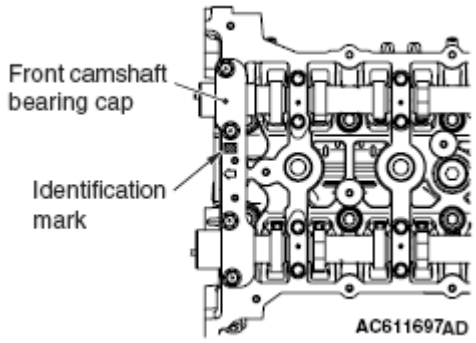


Fig. 101: Identifying Identification Mark Of Camshaft Bearing
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

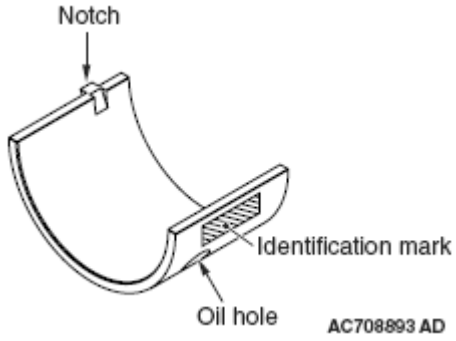


Fig. 102: Identifying Notch, Identification Mark And Oil Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

NOTE: Because the thrust camshaft bearing 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 bolt to the specified torque in the order of number shown in the figure in two or three steps.

Tightening torque: 12 ± 1 N.m (107 ± 8 in-lb)

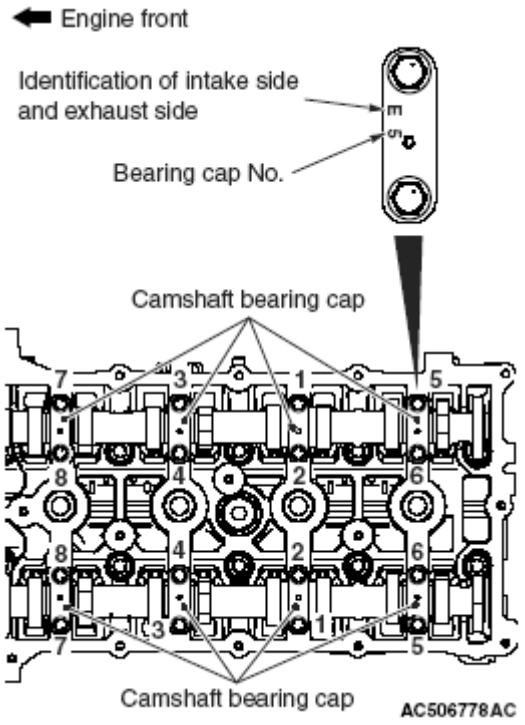


Fig. 103: Identifying Camshaft Bearing Caps To Cylinder Heads
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> E << FRONT CAMSHAFT BEARING CAP ASSEMBLY INSTALLATION

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

1. Install the front camshaft bearing cap to the cylinder head, and temporarily tighten the front camshaft bearing cap to the specified torque in the order of the figure (1).

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

2. Tighten the front camshaft bearing cap again to the specified torque in the order of the figure (2).

   Tightening torque: 30 ± 2 N.m (23 ± 1 ft-lb)

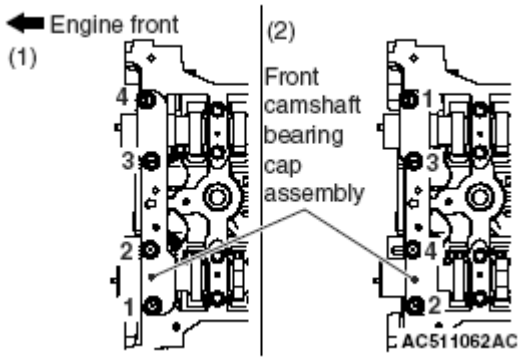


Fig. 104: Identifying Front Camshaft Bearing Cap Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> F << 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 3mm (0.12 inch) play. After the check, install the stopper securely.

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

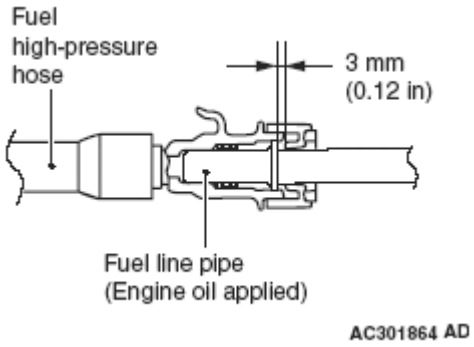


Fig. 105: Identifying Fuel High-Pressure Hose And Fuel Line Pipe
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

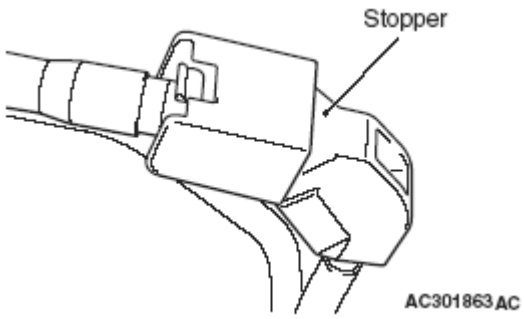


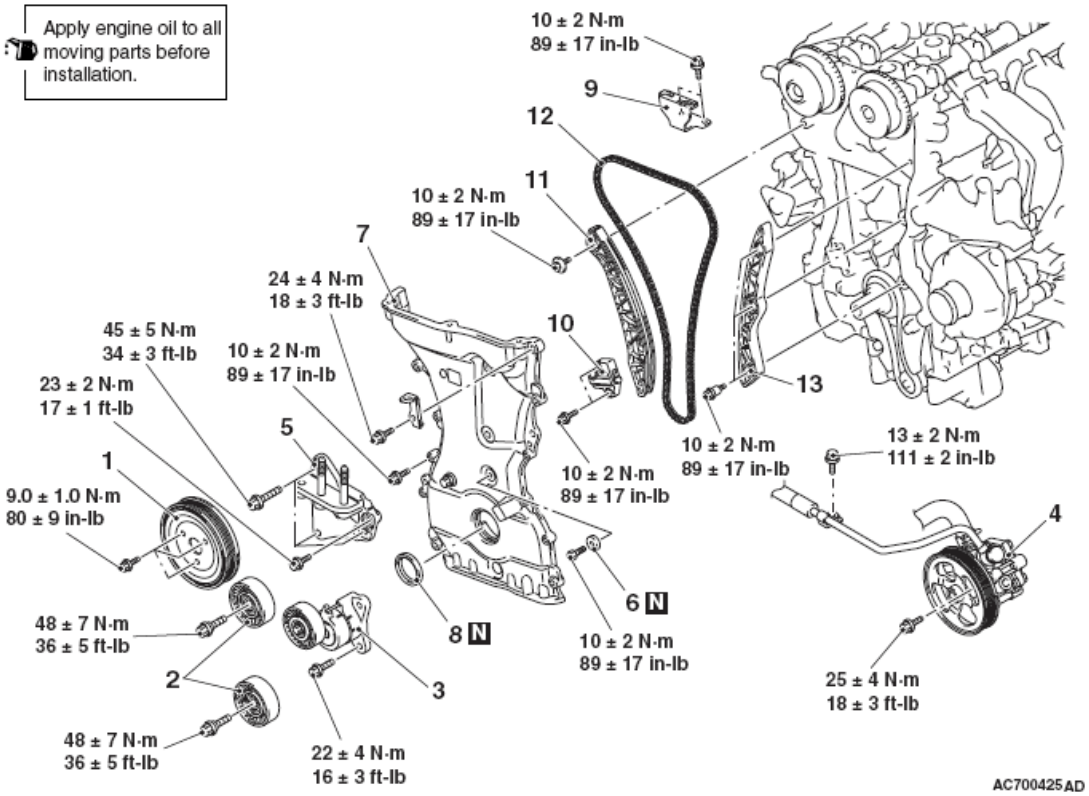
Fig. 106: Identifying Stopper

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING CHAIN

REMOVAL AND INSTALLATION

Pre-removal operation	Post-installation operation
• Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal • Engine Oil Draining • Rocker Cover Assembly Removal • Engine Oil Pan Removal	• Engine Oil Pan Installation • Rocker Cover Assembly Installation • Engine Oil Refilling • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation



Removal steps

<<A>> • Crankshaft pulley

>>E<< 1. Water pump pulley
2. Idler pulley
3. Auto-tensioner

<<B>> 4. Power steering oil pump assembly

<<C>>
- Engine and transaxle assembly holding
- Engine mounting insulator

Removal steps (Continued)

5. Cylinder block engine front mounting bracket
6. Gasket

<<D>> >>D<< 7. Timing chain case assembly

>>C<< 8. Crankshaft front oil seal
9. Timing chain upper guide

<<E>> >>B<< 10. Timing chain tensioner
11. Timing chain tension side guide

>>A<< 12. Timing chain
13. Timing chain loose side guide

Fig. 107: Identifying Timing Chain Parts With Torque Specification
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991956: Engine Hanger Plate
- MB991527: Hanger
- MB991454: Engine Hanger Balancer
- MB991895: Engine Hanger
- MB991928: Engine Hanger
- MB991448: Bush Remover and Installer Base

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 >> POWER STEERING OIL PUMP ASSEMBLY REMOVAL

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

<< C >> ENGINE AND TRANSAXLE ASSEMBLY HOLDING

Install a special tool for holding the engine and transaxle assembly.

1. < Engine hanger MB991928 is used >
    1. Assemble special tool engine hanger (MB991928) (Set the following parts on the base hanger).
        - Slide bracket (HI)
        - Foot x 2 (standard) (MB991932)
        - Foot x 2 (short) (MB991933)
        - Joint x 2 (90) (MB991930)
    2. Set the foot of the special tools (MB991930, MB991932 and MB991933) as shown in the figure.

NOTE: Slide the slide bracket (HI) to adjust the engine hanger balance.

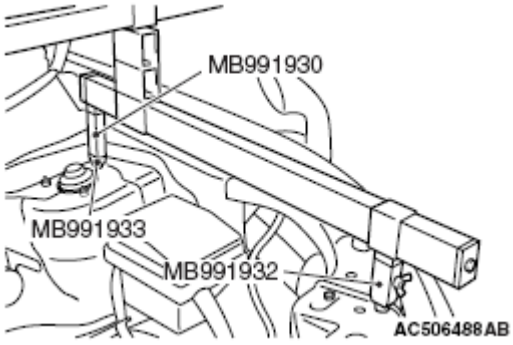


Fig. 108: Identifying Special Tool Of Engine And Transaxle Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Install special tool MB991956 to the cylinder head, and set special tool MB991527 and the chains of special tool MB991454 to the engine assembly to hold the engine and transaxle assembly.

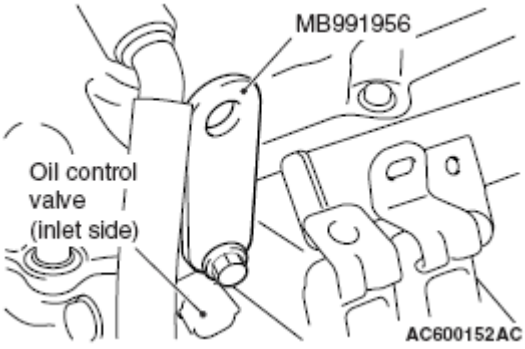


Fig. 109: Identifying Special Tool MB991956 And Oil Control Valve
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

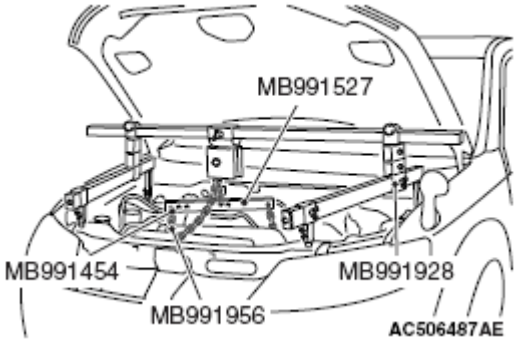


Fig. 110: Identifying Special Tool Engine Hanger (MB991928 Or MB991956)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. < Engine hanger MB991895 is used >

CAUTION: Place a rag between special tool MB991895 and the windshield to

prevent the special tool MB991895 from interfering with the windshield.

1. Set the foot of special tool MB991895 as shown in the figure.

NOTE: Slide the foot to adjust the engine hanger balance.

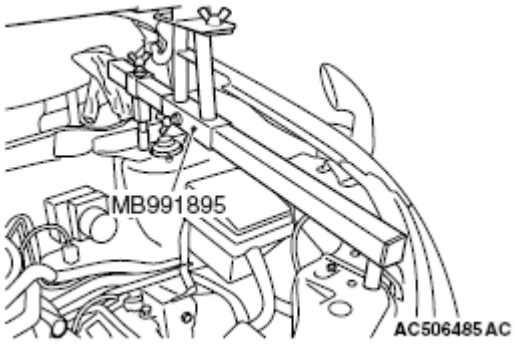


Fig. 111: Identifying Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

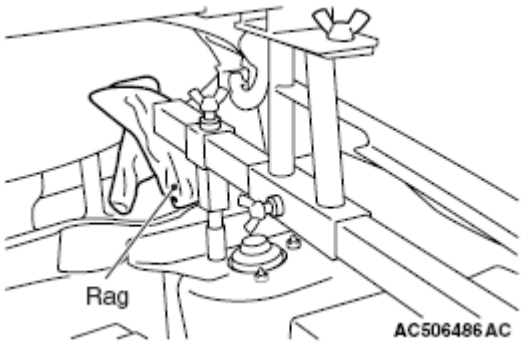


Fig. 112: Identifying Rag
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Install special tool MB991956 to the cylinder head, and set special tool MB991527 and the chains of special tool MB991454 to the engine assembly to hold the engine and transaxle assembly.

<< D >> 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.

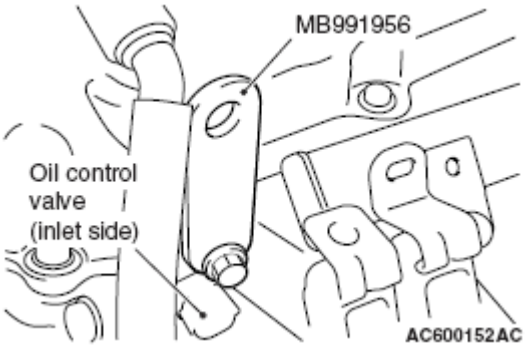


Fig. 113: Identifying Special Tool MB991956 And Oil Control Valve
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

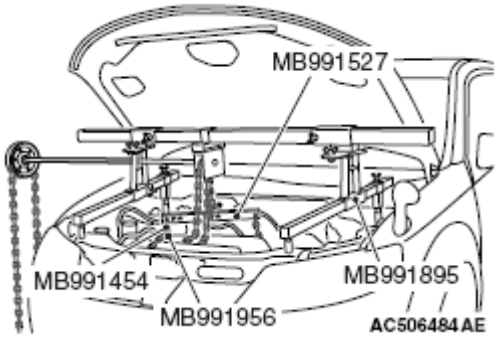


Fig. 114: Identifying Special Tool Engine Hanger (MB991454 Or MB991995)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

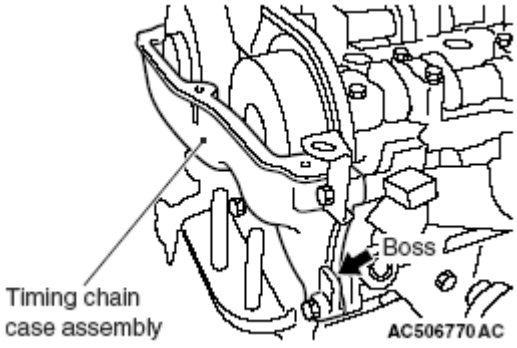


Fig. 115: Identifying Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 figure, pry slightly, and remove the timing chain case assembly from the cylinder head and cylinder block.

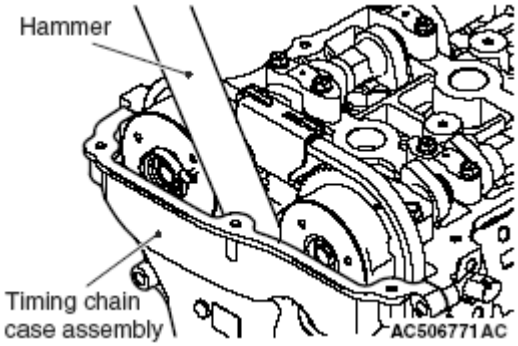


Fig. 116: Inserting Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< E >> 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 figure and set the cylinder No. 1 to the top dead center of compression stroke.

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

3. Remove the crankshaft pulley installed temporarily.

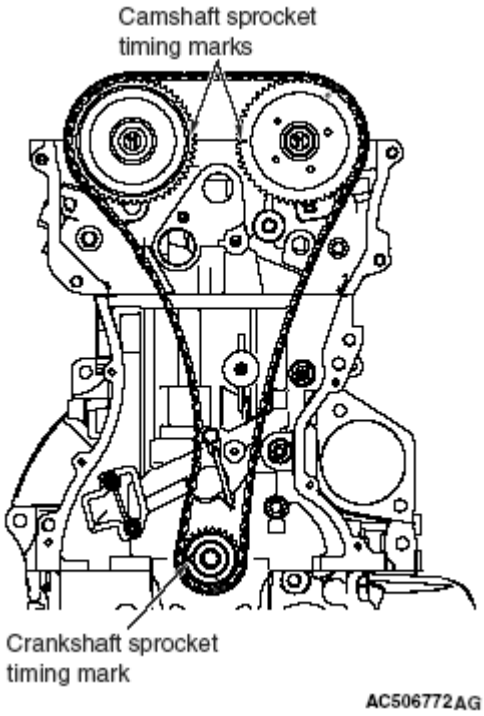


Fig. 117: Identifying Camshaft Sprocket Timing Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Using a flat-tipped precision 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[0.05 inch]) to fix the plunger of the timing chain tensioner.
6. Remove the timing chain tensioner.

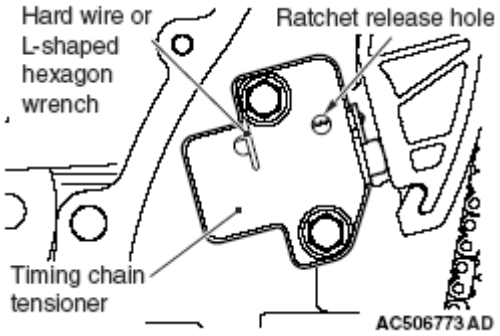


Fig. 118: Identifying Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << TIMING CHAIN INSTALLATION

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

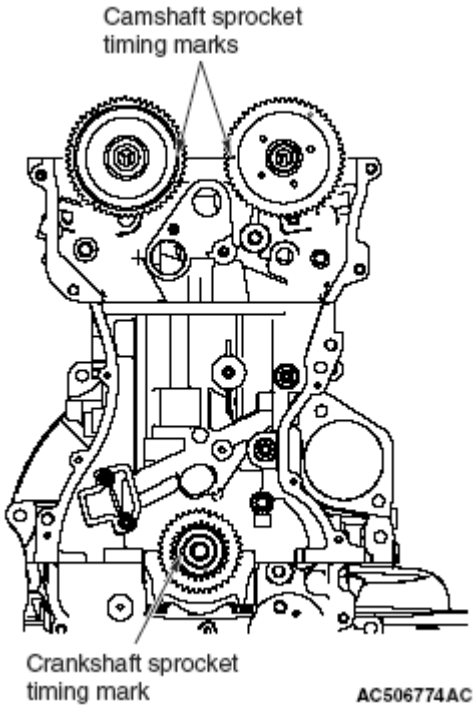


Fig. 119: Identifying Camshaft Sprockets And Crankshaft Sprockets Timing Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

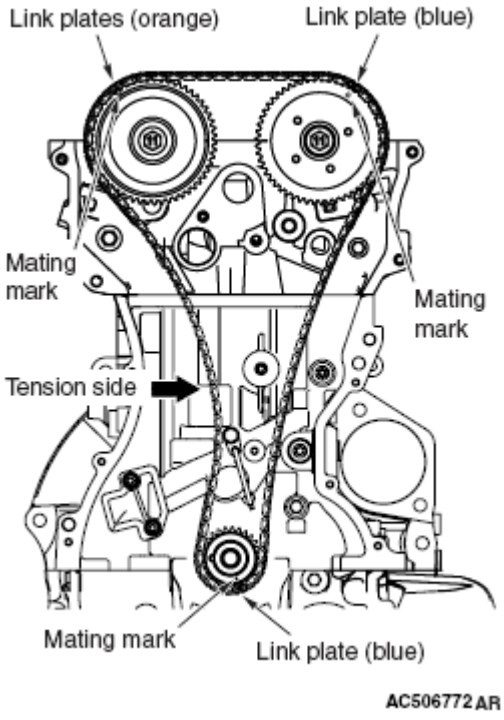


Fig. 120: Identifying Link Plate Mark Location
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << TIMING CHAIN TENSIONER INSTALLATION

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

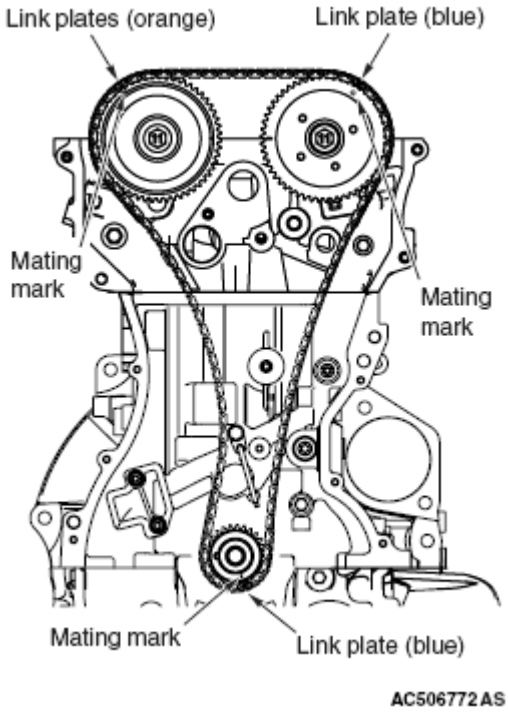


Fig. 121: Identifying Link Plate Mark Location
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

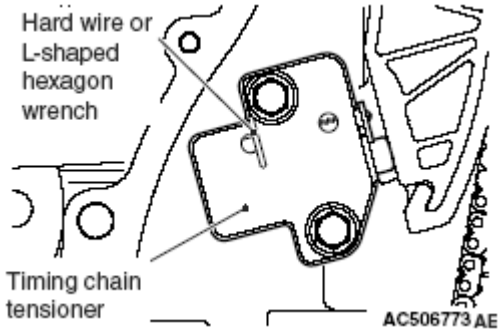


Fig. 122: Identifying Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> 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.

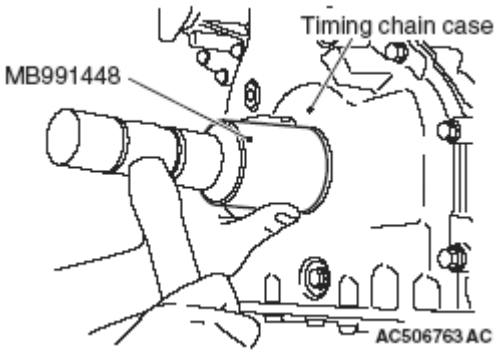


Fig. 123: Installing Crankshaft Front Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> D << 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. Remove sealant from the timing chain case assembly and the timing chain case assembly mounting surface of the cylinder block and the cylinder head, and degrease the surface where the sealant is applied by white gasoline or the like.
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 white gasoline.
3. As for the three-surface aligned part that is indicated in Step 2, the engine oil oozes from the cylinder head gasket. Thus, quickly apply the sealant to it after degreasing.
4. Apply a bead of the sealant to the timing chain case assembly mounting surface. The bead diameter should be 2.5 ± 0.5 mm (0.1 ± 0.02 inch). Overlap the part "A" with the diameter of 4.5 ± 0.5 mm (0.18 ± 0.02 inch) or 2.5 ± 0.5 mm (0.1 ± 0.02 inch) as shown in the figure, and apply the sealant.

Specified sealant: Three bond 1217G or equivalent

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.**
- **Do not apply oil or water to the sealant-applied area or start up the engine within 2 hours after the installation of the timing chain case assembly.**

5. Install the timing chain case assembly to the cylinder block and cylinder head so that the sealant does not contact other parts.

NOTE: Install the timing chain case assembly within 3 minutes after the application of sealant.

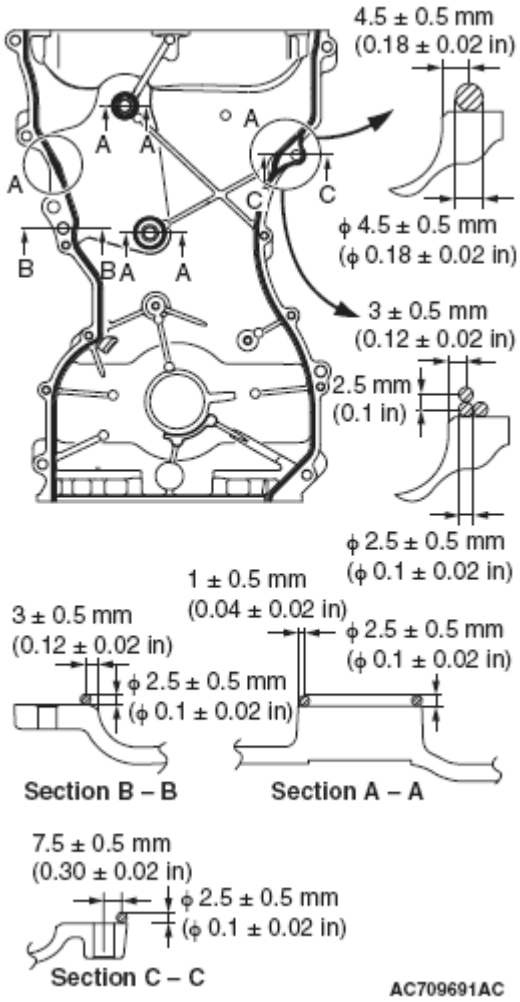


Fig. 124: Identifying Timing Chain Case Assembly Gap Dimension
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Insert the bolts to the timing chain case assembly and tighten them to the specified torque.

TIGHTENING TORQUE SPECIFICATION

Bolt (symbol)	Thread diameter x Length mm	Tightening torque
Flange bolt (A)	M6 x 25	10 ± 2 N.m (89 ± 17 in-lb)
Flange bolt (B)	M8 x 28	24 ± 4 N.m (18 ± 2 ft-lb)
Bolt (C)	M6 x 25	10 ± 2 N.m (89 ± 17 in-lb)

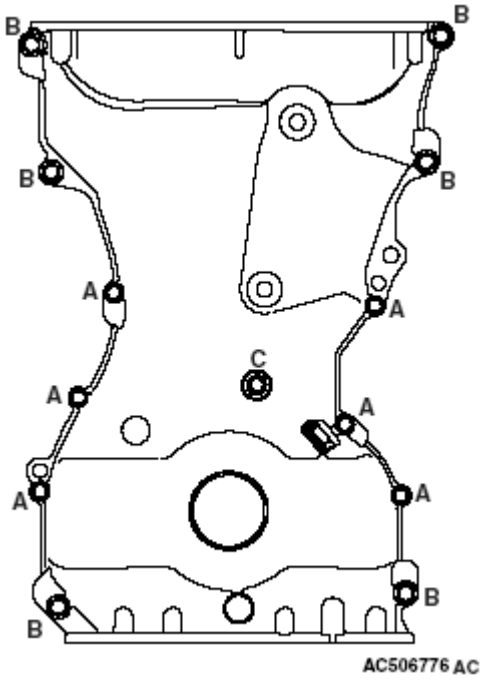


Fig. 125: Identifying Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

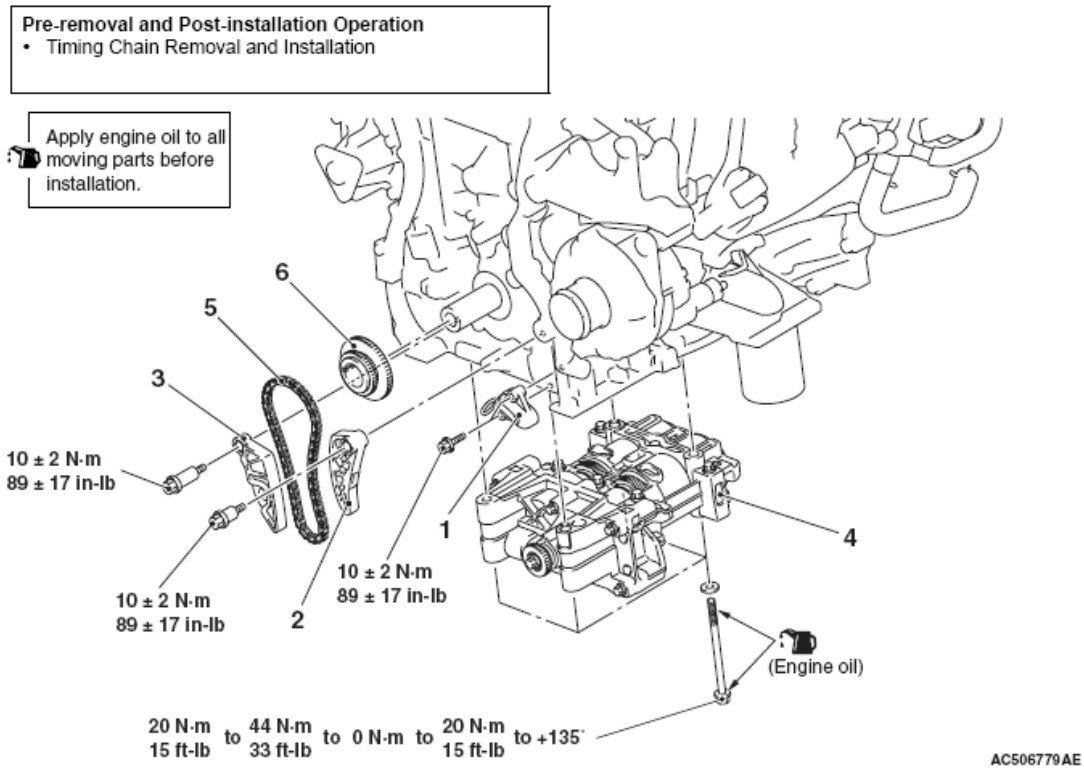
>> E << WATER PUMP PULLEY INSTALLATION

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

Tightening torque: 9.0 ± 1.0 N.m (80 ± 9 in-lb)

BALANCER TIMING CHAIN, BALANCER SHAFT AND OIL PUMP MODULE

REMOVAL AND INSTALLATION



		Removal steps
<<A>> >>B<<	1.	Timing chain tensioner
	2.	Balancer timing chain guide
	3.	Balancer timing chain guide

		Removal steps (Continued)
>>A<<	4.	Balancer shaft and oil pump module
>>A<<	5.	Balancer timing chain
>>A<<	6.	Crankshaft sprocket

Fig. 126: Identifying Balancer Timing Chain, Balancer Shaft And Oil Pump Module With Torque Specification
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MB991614: Angle Gauge

REMOVAL SERVICE POINT

<< A >> TIMING CHAIN TENSIONER REMOVAL

CAUTION: Securely install the plunger of the timing chain tensioner. Otherwise, it may pop out.

1. Press the balancer timing chain against the timing chain tensioner, compress the plunger of the timing chain tensioner and insert hard wire (piano wire, etc.) or L-shaped hexagon wrench (1.5 mm [0.05 inch]) to fix the plunger of the timing chain tensioner.
2. Remove the timing chain tensioner.

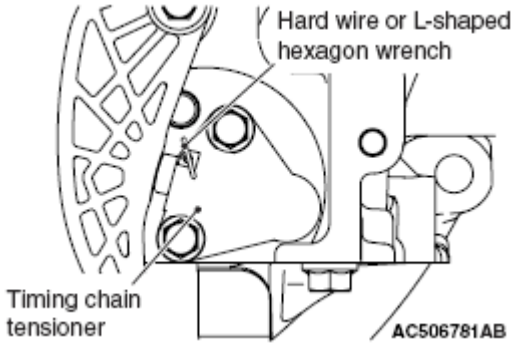


Fig. 127: Removing Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << CRANKSHAFT SPROCKET/BALANCER TIMING CHAIN/BALANCER SHAFT AND OIL PUMP MODULE INSTALLATION

1. When installing the new balancer shaft and oil pump module, apply oil to the oil pump in the balancer shaft and oil pump module and the balancer shaft bearing as follows.
    1. Clean the inside of the removed engine oil pan, and put the balancer shaft and oil pump module into the engine oil pan with its oil inlet port facing up.
    2. Pour new engine oil until two-thirds of the balancer shaft and oil pump module is soaked.
    3. Fill the engine oil (approximately 50 cm^3 [3.05 cu.in.]) into the balancer shaft and oil pump module from the oil inlet port.

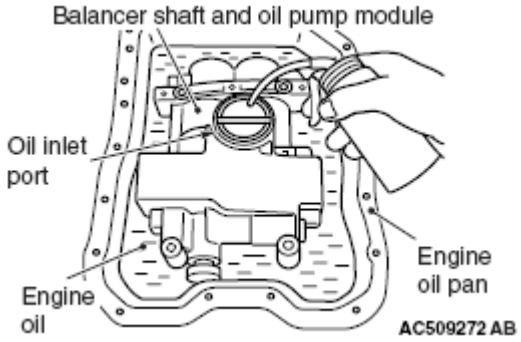


Fig. 128: Identifying Engine Oil, Oil Inlet Port And Engine Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Turn the balancer shaft sprocket of the balancer shaft and oil pump module clockwise four rotations or more to apply the engine oil to the entire area of the oil pump and the balancer shaft bearing.

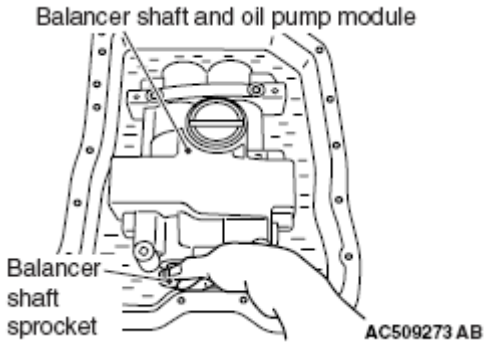


Fig. 129: Identifying Balancer Shaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. With the link marks (orange or blue) of balancer timing chain aligned with the timing marks of balancer sprocket and crankshaft sprocket, install the balancer shaft and oil pump module together with the balancer timing chain and crankshaft sprocket as one unit to the cylinder block. At this time, securely bring the balancer shaft and oil pump module into contact with the rudder frame mounting area.
3. Apply an adequate and minimum amount of engine oil to the threads and bearing surfaces of the balancer shaft and oil pump module bolts.

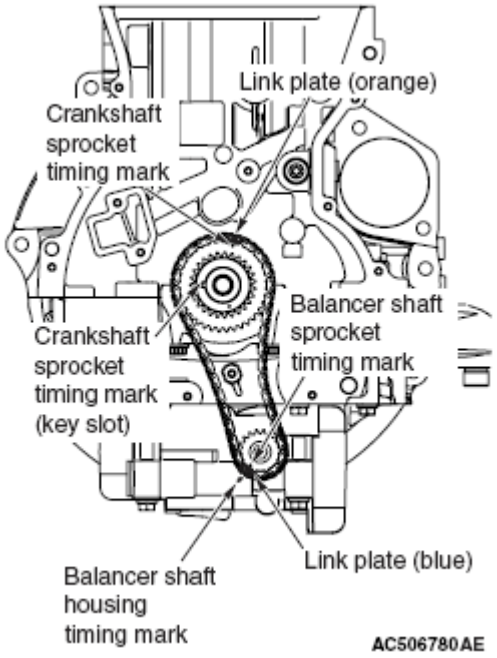


Fig. 130: Identifying Link Marks (Orange Or Blue) Of Balancer Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Tighten the balancer shaft and oil pump module bolts to the specified torque of 20 N.m (15 ft-lb) in the order of number shown in the figure.
5. Retighten the balancer shaft and oil pump module bolts to the specified torque of 44 N.m (33 ft-lb) in the order of number shown in the figure.

6. Loosen each balancer shaft and oil pump module bolt fully in the reverse sequence to that shown.
7. Tighten the balancer shaft and oil pump module bolts to the specified torque of 20 N.m (15 ft-lb) in the order of number shown in the figure.

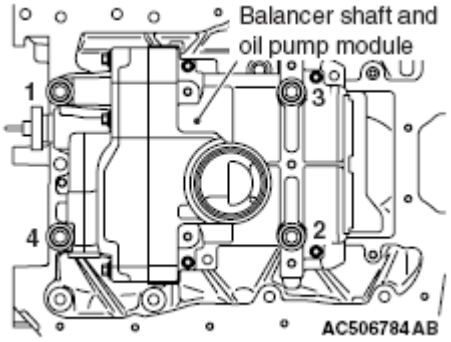


Fig. 131: Identifying Balancer Shaft And Oil Pump Module
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. After tightening to the specified torque, tighten the balancer shaft and oil pump module bolts to 135 degrees, using special tool MB991614, in the order of number shown in the figure.

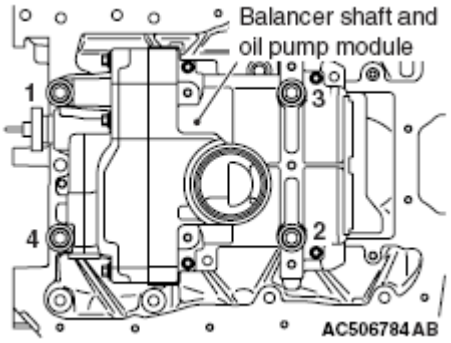


Fig. 132: Identifying Balancer Shaft And Oil Pump Module
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

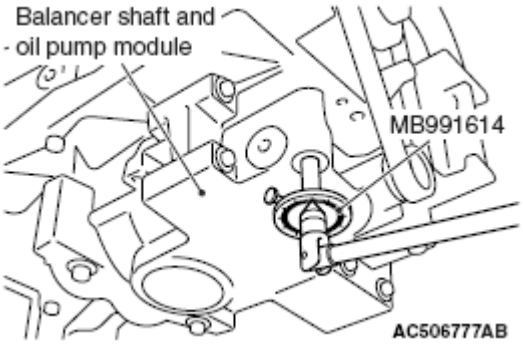


Fig. 133: Identifying Balancer Shaft And Oil Pump Module
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << TIMING CHAIN TENSIONER INSTALLATION

1. Install the timing chain tensioner to the cylinder block.
2. Remove the hard wire or L-shaped hexagon wrench fixing the plunger of the timing chain tensioner to apply tension to the balancer timing chain.

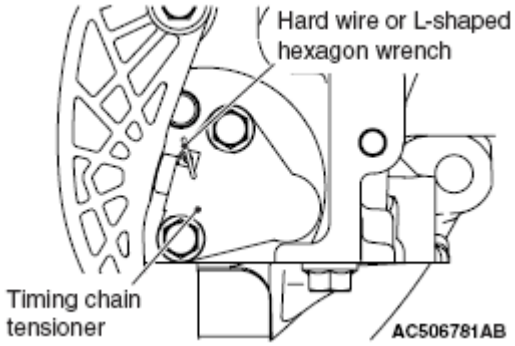


Fig. 134: Installing Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

BALANCER SHAFT AND OIL PUMP MODULE

REMOVAL AND INSTALLATION

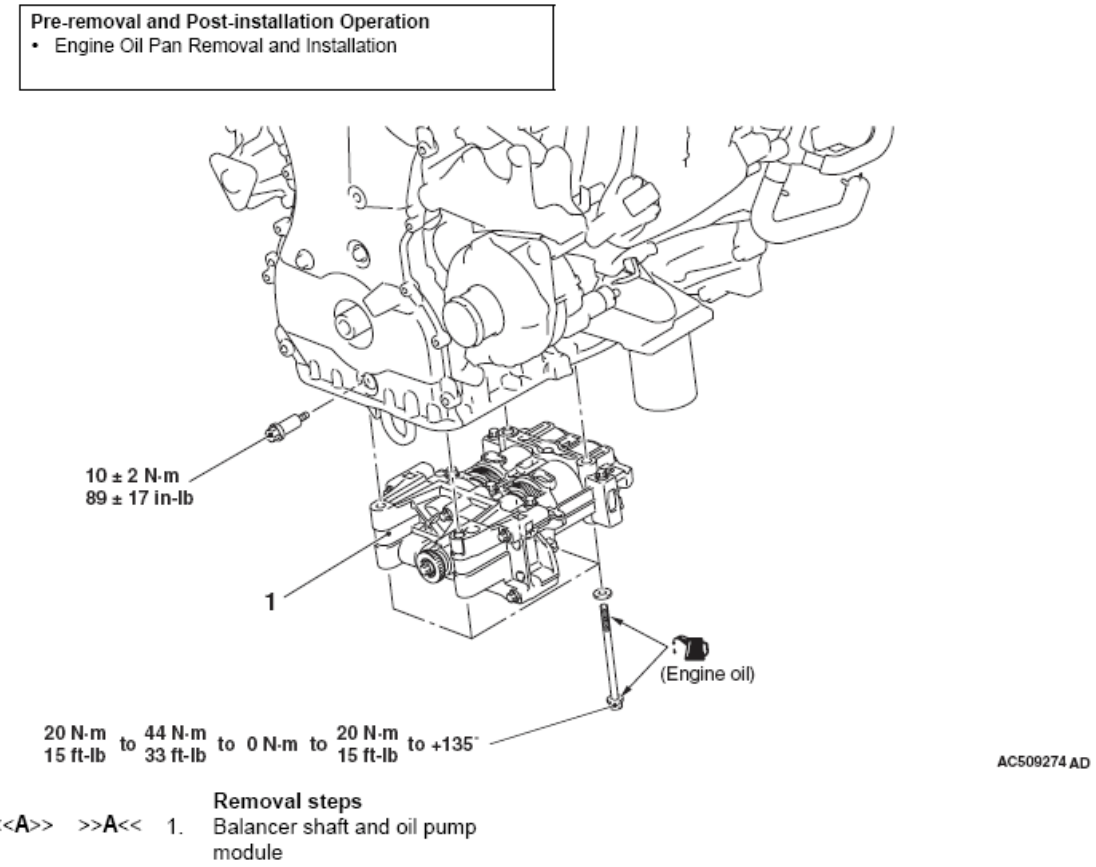


Fig. 135: Identifying Balancer Shaft And Oil Pump Module With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MB991614: Angle Gauge

REMOVAL SERVICE POINT

<< A >> BALANCER SHAFT AND OIL PUMP MODULE REMOVAL

CAUTION:
- **Turn the crankshaft clockwise.**
- **Never turn the crankshaft after the cylinder No. 1 or No. 4 is set to the top dead center of compression.**

1. Turn the crankshaft clockwise to align the timing mark of the balancer shaft sprocket with the timing mark of the balancer shaft and oil pump module, and set the cylinder No. 1 or No. 4 to the top dead center of compression.
2. Put paint marks on the balancer shaft sprocket timing mark and balancer timing chain.

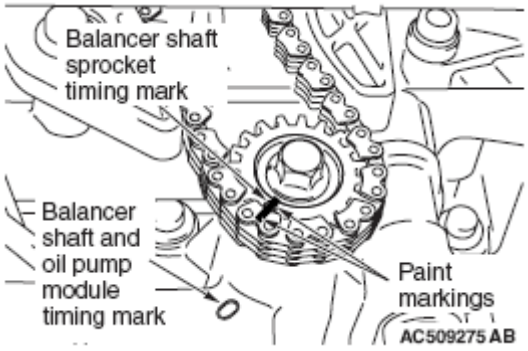


Fig. 136: Identifying Balancer Shaft Sprocket Timing Mark And Balancer Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Securely install the plunger of the timing chain tensioner. Otherwise, it may pop out.

3. Press the balancer timing chain against the timing chain tensioner, compress the plunger of the timing chain tensioner and insert L-shaped hard wire (piano wire, etc.) or L-shaped hexagon wrench (1.5 mm [0.05 inch]) to the plunger fixing hole of the timing chain tensioner from under the timing chain case, and fix the plunger of the timing chain tensioner.

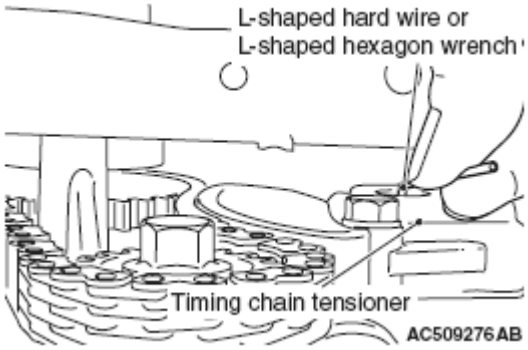


Fig. 137: Identifying Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

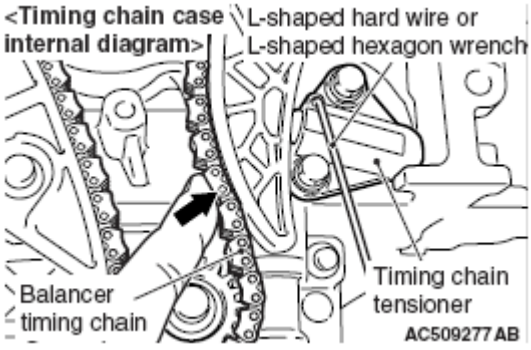


Fig. 138: Identifying Timing Chain Tensioner And Balancer Timing Chain

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Use a wrench to remove the mounting bolt at the lower side of the balancer timing chain guide shown in the figure so that the balancer timing chain guide is unrestricted.
5. Support the balancer shaft and oil pump module with a hand, and remove the balancer shaft and oil pump module mounting bolt.

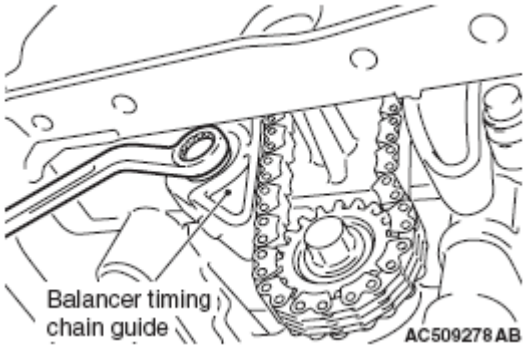


Fig. 139: Removing Balancer Timing Chain Guide
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Remove the balancer shaft and oil pump module from the rudder frame with the balancer timing chain attached, and move it to the center of the engine.
7. Remove the balancer timing chain from the balancer shaft and oil pump module, and remove the balancer shaft and oil pump module.

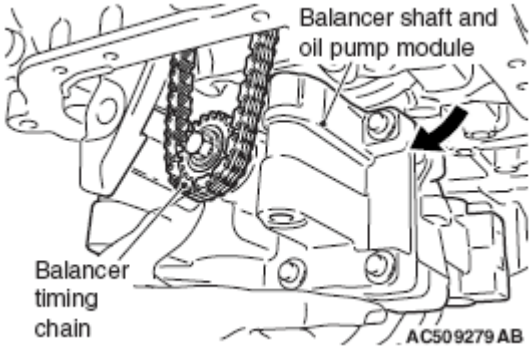


Fig. 140: Identifying Balancer Timing Chain And Balancer Shaft And Oil Pump Module
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: When the tooth jump of the balancer timing chain from the crankshaft sprocket occurs, the timing between the balancer shaft and the oil pump module becomes off, resulting in the abnormal engine vibration. Be sure that the tooth jump will not occur.

8. After the balancer shaft and oil pump module is removed, using a cable band, tie the balancer timing chain at the protrusion of the rudder frame to prevent the tooth jump of balancer timing chain from the

crankshaft sprocket.

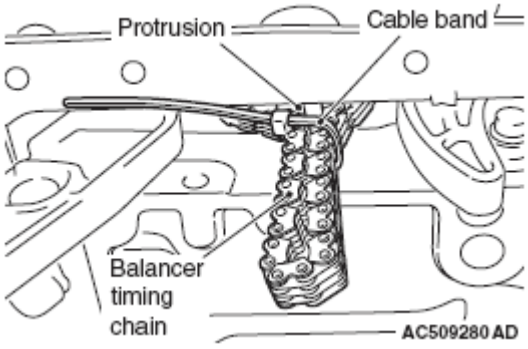


Fig. 141: Identifying Balancer Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINT

>> A << BALANCER SHAFT AND OIL PUMP MODULE INSTALLATION

1. When installing the new balancer shaft and oil pump module, apply oil to the oil pump in the balancer shaft and oil pump module and the balancer shaft bearing as follows.
    1. Clean the inside of the removed engine oil pan, and put the balancer shaft and oil pump module into the engine oil pan with its oil inlet port facing up.
    2. Pour new engine oil until two-thirds of the balancer shaft and oil pump module is soaked.
    3. Fill the engine oil (approximately 50 cm^3 [3.05 cu.in.]) into the balancer shaft and oil pump module from the oil inlet port.

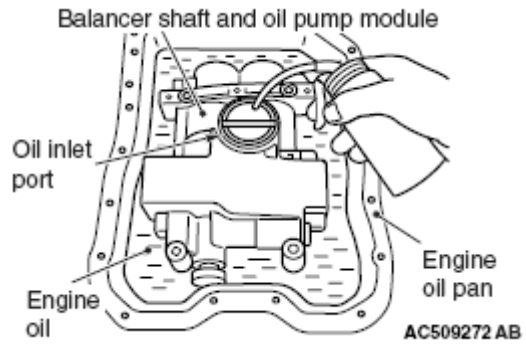


Fig. 142: Filling Engine Oil Into Balancer Shaft And Oil Pump Module
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

    4. Turn the balancer shaft sprocket of the balancer shaft and oil pump module clockwise four rotations or more to apply the engine oil to the entire area of the oil pump and the balancer shaft bearing.
2. Remove the cable band installed to prevent the tooth jump of the balancer timing chain from the crankshaft sprocket from the balancer timing chain.

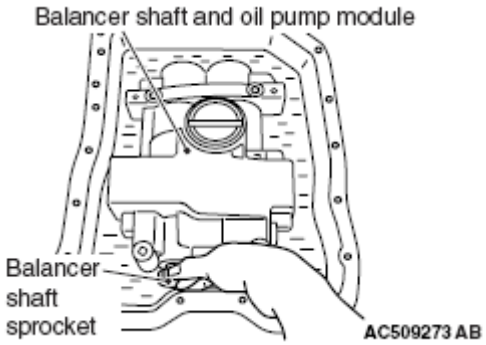


Fig. 143: Identifying Balancer Shaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Regarding the prevention of the tooth jump of the balancer timing chain, install the balancer shaft sprocket to the balancer timing chain with aligning the paint marking of the balancer shaft sprocket (the timing mark of the new balancer shaft and oil pump module) with that of the balancer timing chain.
4. With the paint marking of the balancer timing chain aligned with that of the balancer sprocket (the timing mark of the new balancer shaft and oil pump module), install the balancer shaft and oil pump module to the rudder frame. Securely bring the balancer shaft and oil pump module into contact with the rudder frame mounting area.

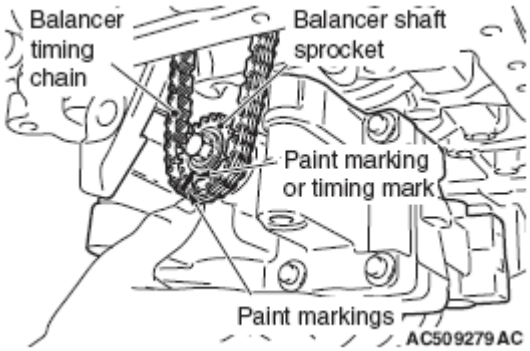


Fig. 144: Identifying Balancer Shaft Sprocket And Balancer Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Apply an adequate and minimum amount of engine oil to the threads and bearing surfaces of the balancer shaft and oil pump module bolts.
6. Tighten the balancer shaft and oil pump module bolts to the specified torque 20 N.m (15 ft-lb) in the order of number shown in the figure.
7. Tighten the balancer shaft and oil pump module bolts again to the specified torque 44 N.m (33 ft-lb) in the order of number shown in the figure.
8. Loosen the balancer shaft and oil pump module bolts fully in the reverse sequence to that shown.
9. Tighten the balancer shaft and oil pump module bolts to the specified torque 20 N.m (15 ft-lb) in the order of number shown in the figure.

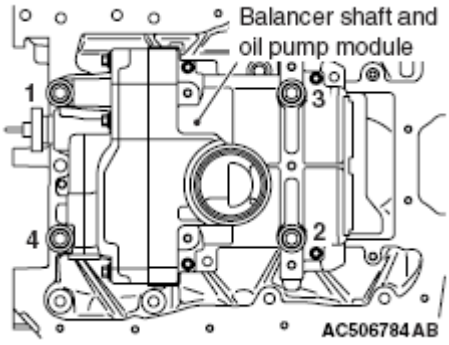


Fig. 145: Identifying Balancer Shaft And Oil Pump Module
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

10. After tightening to the specified torque, tighten the balancer shaft and oil pump module bolts to 135 degrees, using special tool MB991614, in the order of number shown in the figure.
11. Tighten the mounting bolt of the balancer timing chain lower with the standard torque.

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

12. Remove the plunger of the timing chain tensioner using the L-shaped hard wire (piano wire, etc.) or L-shaped hexagon wrench (1.5 mm [0.05 inch]).

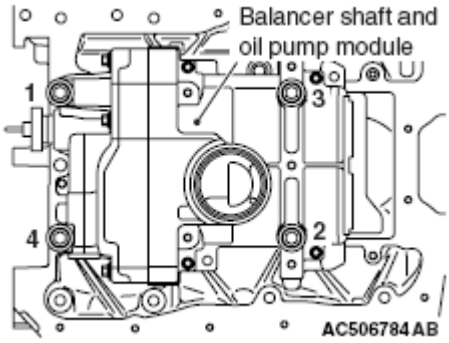


Fig. 146: Identifying Balancer Shaft And Oil Pump Module
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

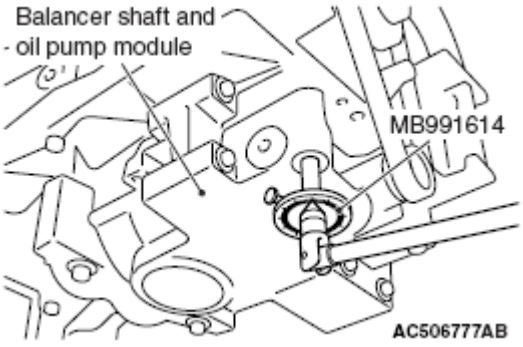


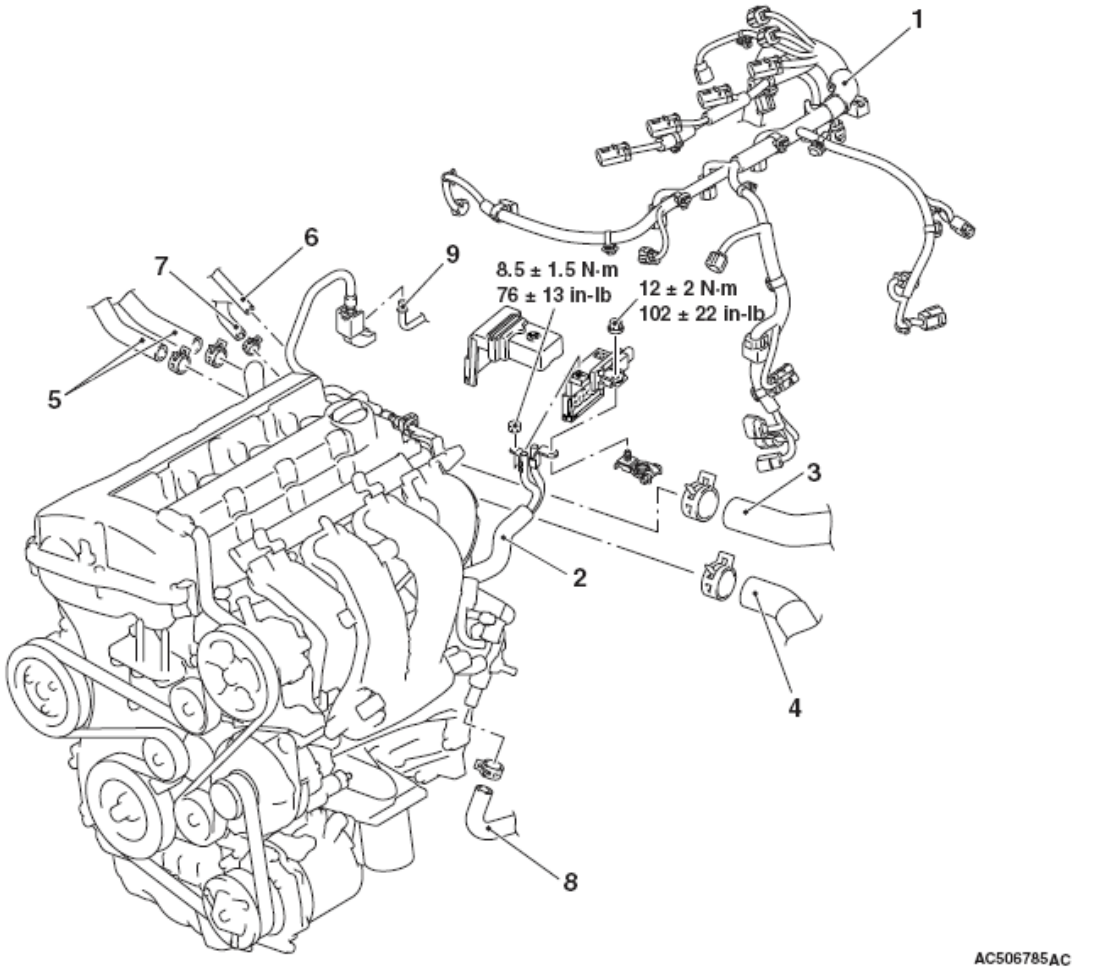
Fig. 147: Identifying Balancer Shaft And Oil Pump Module

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

CAUTION: When the engine assembly replacement is performed, use scan tool MB991958 to initialize the learning value (Refer to INITIALIZATION PROCEDURE FOR LEARNING VALUE IN MFI ENGINE).



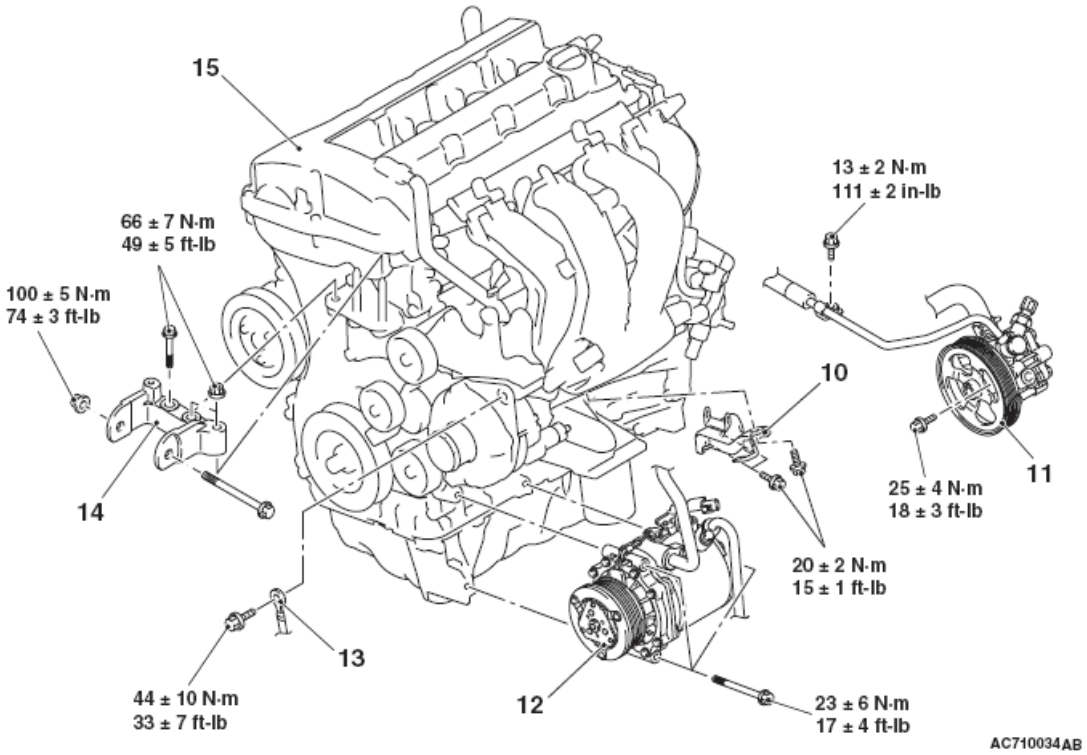
Removal steps
1. Control wiring harness connection
2. Battery cable connection
3. Radiator upper hose connection
4. Radiator lower hose connection
5. Heater hose connection
6. Emission vacuum hose connection

<<A>> >>E<<

Removal steps (Continued)
7. Brake booster vacuum hose connection
8. Cooling water line hose connection
9. Fuel high-pressure hose connection

• Drive belt

Fig. 148: Identifying Engine Assembly With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



	Removal steps		Removal steps (Continued)
•	Transaxle assembly	<<C>> >>D<<	12. A/C compressor and clutch assembly
		>>C<<	13. Grounding cable connection
10.	Intake manifold stay	<<D>> >>B<<	14. Engine mounting bracket
<<B>>	11. Power steering oil pump assembly	<<E>> >>A<<	15. Engine assembly

Fig. 149: Identifying Engine Assembly With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991956: Engine Hanger Plate
- MB991527: Hanger
- MB991454: Engine Hanger Balancer
- MB991895: Engine Hanger
- MB991928: Engine Hanger

REMOVAL SERVICE POINTS

<< A >> FUEL HIGH-PRESSURE HOSE REMOVAL

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

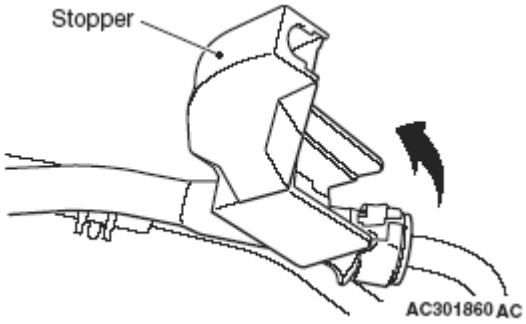


Fig. 150: Identifying Stopper And Retainer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

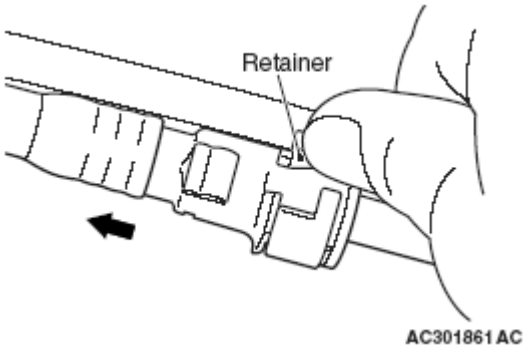


Fig. 151: Raising Retainer Of Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> POWER STEERING OIL PUMP ASSEMBLY REMOVAL

1. Remove the power steering oil pump assembly with hose on it.
2. Tie the removed power steering oil pump with a string at a position where it will not interfere with the removal and installation of engine assembly.

<< C >> 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.

<< D >> ENGINE MOUNTING BRACKET REMOVAL

CAUTION: When supporting the engine and transaxle 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 special tools engine hanger (MB991928 or MB991895) which was installed for supporting the engine assembly when the transaxle assembly was removed. Refer to **TRANSAXLE ASSEMBLY** .
3. Operate a garage jack so that the engine weight is not applied to the engine mounting insulator, and remove the engine mounting bracket.

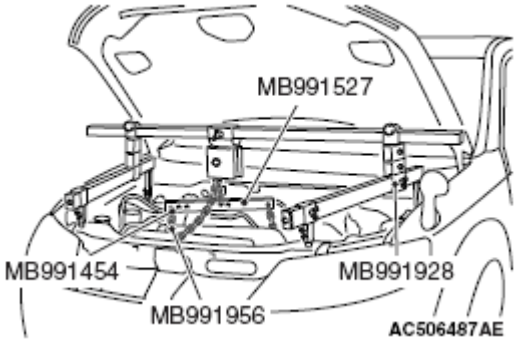


Fig. 152: Identifying Special Tool Engine Hanger (MB991928 Or MB991956)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

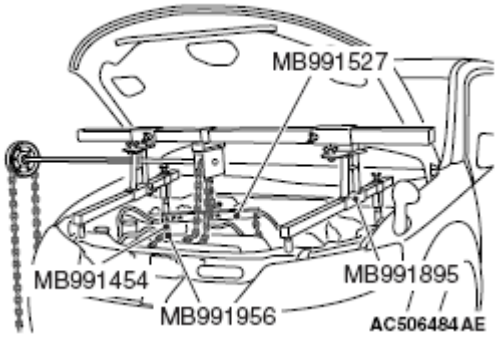


Fig. 153: Identifying Special Tool Engine Hanger (MB991454 Or MB991995)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< E >> 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.

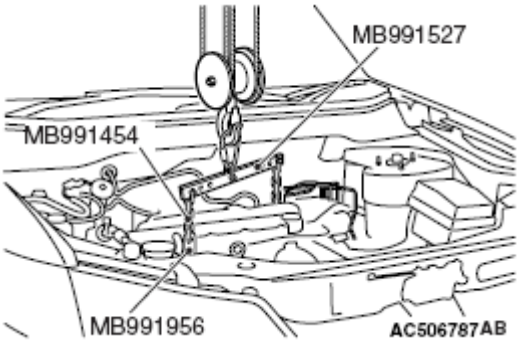


Fig. 154: Identifying Special Tool MB991454, MB991956 And MB991956
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << ENGINE ASSEMBLY INSTALLATION

1. Install special tool MB991956 to the cylinder head, and set special tool MB991527 and the chains of special tool MB991454 to the engine assembly to hold the engine assembly.
2. Install the engine assembly, being careful not to pinch the cables, hoses, or wiring harness connectors.

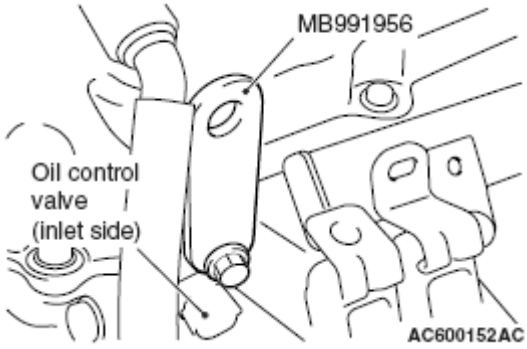


Fig. 155: Identifying Special Tool MB991956 And Oil Control Valve
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

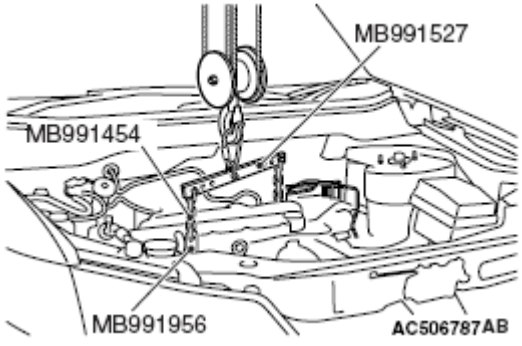


Fig. 156: Identifying Special Tool MB991454, MB991956 And MB991956
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << ENGINE MOUNTING BRACKET INSTALLATION

CAUTION: When supporting the engine and transaxle 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. Install special tool engine hanger (MB991928 or MB991895) which is used during installation of transaxle assembly to hold the engine assembly. Refer to **TRANSAXLE ASSEMBLY** .
3. Remove the garage jack which supports the engine assembly.

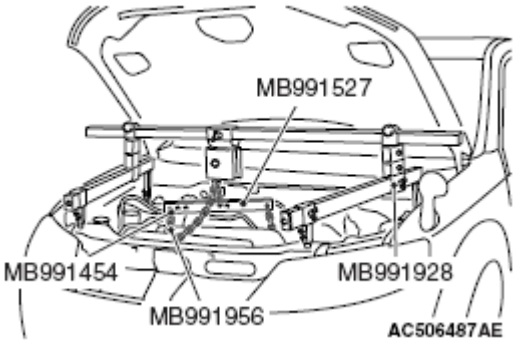


Fig. 157: Identifying Special Tool Engine Hanger (MB991928 Or MB991956)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

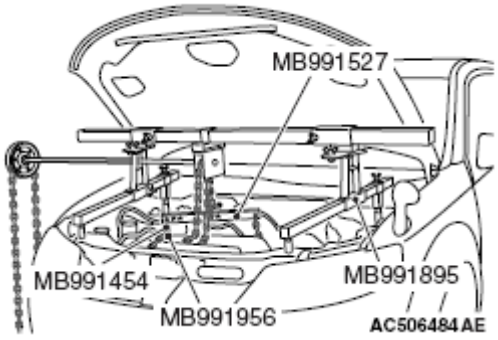


Fig. 158: Identifying Special Tool Engine Hanger (MB991454 Or MB991995)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << GROUNDING CABLE CONNECTION

1. Install the grounding cable in the direction shown in the illustration.
2. Tighten the generator mounting bolt to the specified torque.

Tightening torque: 44 ± 10 N.m (33 ± 7 ft-lb)

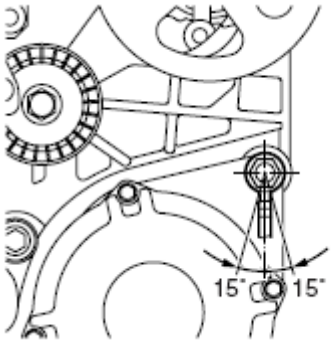


Fig. 159: Tightening Generator Mounting Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> D << A/C COMPRESSOR AND CLUTCH ASSEMBLY INSTALLATION

Tighten A/C compressor and clutch assembly mounting bolts to the specified torque in the order of number shown in the illustration.

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

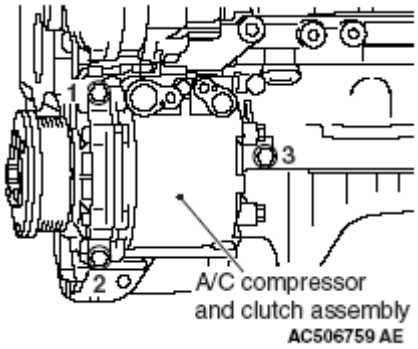


Fig. 160: Identifying A/C Compressor And Clutch Assembly Mounting Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> E << 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 3 mm (0.12 inch) play. After the check, install the stopper securely.

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

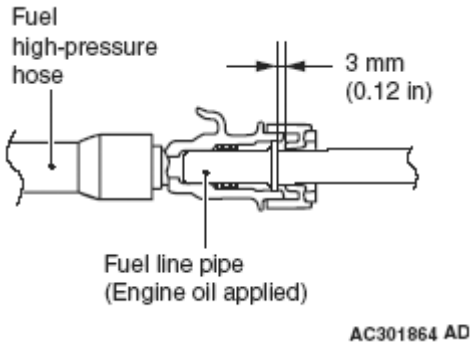


Fig. 161: Identifying Fuel High-Pressure Hose And Fuel Line Pipe
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

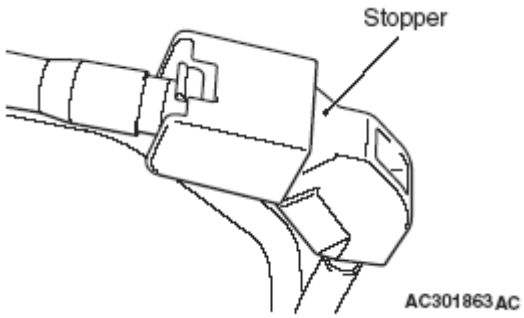


Fig. 162: Identifying Stopper
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

