2010 ENGINE

Engine Mechanical <2.0L Engine Turbo> - Lancer

GENERAL INFORMATION

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

ITEM SPECIFICATIONS

ITEMS			SPECIFICATIONS
Type			In-line DOHC
Number of cylinders			4
Bore mm (in)			86 (3.39)
Stroke mm (in)			86 (3.39)
Total displacement cm^3 (cu. in)			1,998 (121.9)
Compression ratio			9.0
Firing order			1-3-4-2
Valve timing	Intake valve	Opens (BTDC)	10° - 35°
		Closes (ABDC)	62° - 37°
	Exhaust valve	Opens (BBDC)	44° - 9°
		Closes (ATDC)	0° - 35°

ENGINE DIAGNOSIS

SYMPTOMS REFERENCE CHART

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

ITEM SPECIFICATIONS

Item		Standard value	Limit
Drive belt tension	Vibration frequency Hz (Reference)	98 - 124	-
	Tension N (lb) (Reference)	248 - 400 (56 - 90)	-
Valve clearance (at cold) mm (in)	Intake valve	0.20 ± 0.03 (0.008 ± 0.0012)	-
	Exhaust valve	0.30 ± 0.03 (0.012 ± 0.0012)	-
Basic ignition timing at idle		5°BTDC ± 3°	-
Actual ignition timing at curb idle		Approximately 10° BTDC	-
CO contents %		0.5 or less	-
HC contents ppm		100 or less	-
Curb idle speed r/min		700 ± 100	-
Compression pressure (200 r/min) kPa (psi)		1,090 (158)	Minimum 650 (95)
Compression pressure difference of all cylinder kPa (psi)		-	98 (14)
Intake manifold vacuum at curb idle kPa (in Hg)		-	Minimum 60 (18)

SEALANTS

ITEM SPECIFICATIONS

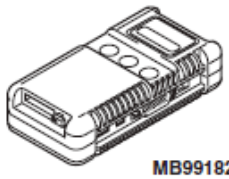
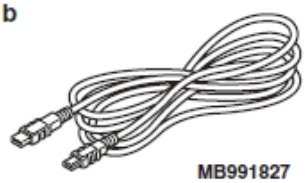
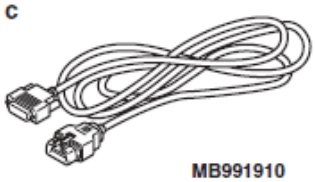
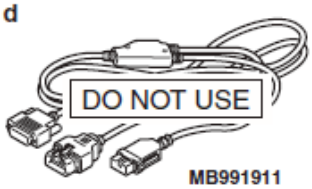
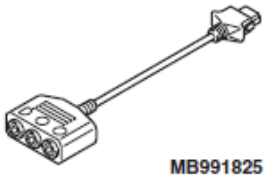
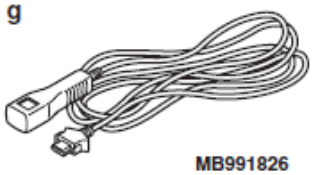
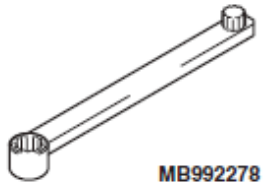
Item	Specified sealant
Rocker cover assembly (matching area of the cylinder head and the timing chain case assembly)	Three bond 1217G (Mitsubishi Genuine Part No. 1000A923), Three bond 1227D, LOCTITE 5900 or equivalent
Engine oil pan	Three bond 1217G (Mitsubishi Genuine Part No. 1000A923), Three bond 1227D, Three bond 1207F (Mitsubishi Genuine Part No. 1000A992), LOCTITE 5971, LOCTITE 5970, LOCTITE 5900 or equivalent

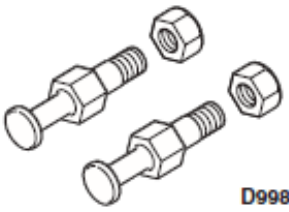
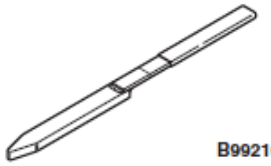
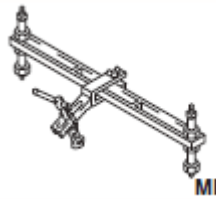
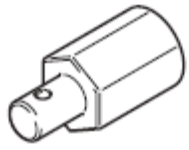
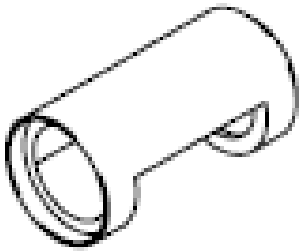
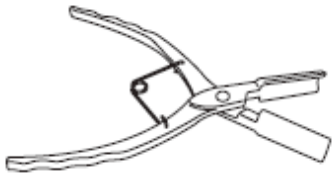
Flywheel bolt	Three bond 1324 or exact equivalent
Crankshaft rear oil seal case	Three bond 1227D, LOCTITE 5971 or equivalent
Cylinder head gasket (matching area of the cylinder block and the cylinder head)	Three bond 1217G (Mitsubishi Genuine Part No. 1000A923), LOCTITE 5900 or equivalent
Timing chain case assembly	

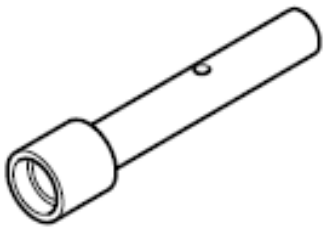
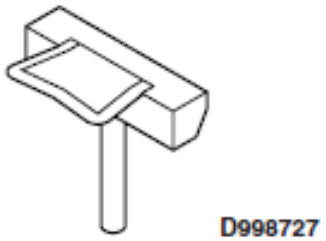
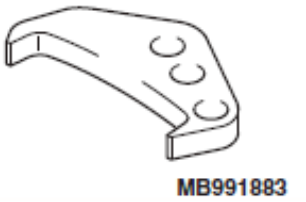
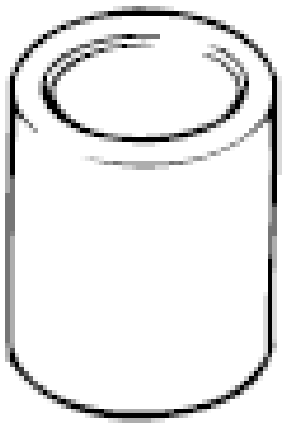
SPECIAL TOOLS

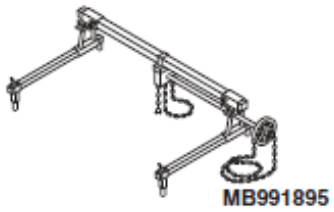
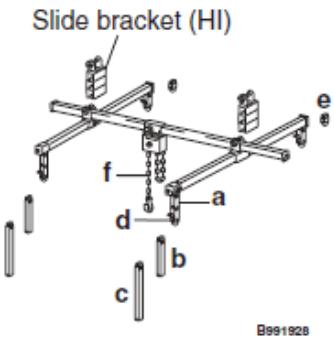
SPECIAL TOOLS CHART

Tool	Tool number and 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	MB991824-KIT **NOTE: MB991826**	**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**

a  MB991824 b  MB991827 c  MB991910 d  MB991911 e  MB991914 f  MB991825 g  MB991826 MB991958	M.U.T.-III main harness B (Vehicles without CAN communication system) e. MB991914 M.U.T.-III main harness C (for Chrysler models only) f. MB991825 M.U.T.-III adapter harness g. MB991826 M.U.T.-III trigger harness	**M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.**	**function correctly.** • Ignition timing check • Curb idle speed check • Idle mixture check • Erasing the diagnostic trouble code
 MB992278	MB992278 Belt tension release wrench		Auto-tensioner tension release

 B990767	MB990767 Front hub and flange yoke holder	MB990767-01	Holding the crankshaft pulley
 D998719	MD998719 Pin	MIT308239	
 B992103	MB992103 Chain tension release bar	-	Camshaft and camshaft sprocket assembly (exhaust side) removal
 MD998772	MD998772 Valve spring compressor	General service tool	Valve spring compression
 B992090	MB992090 Retainer holder attachment	-	
	MB992089 Retainer holder C	-	
	MB992085 Valve stem seal pliers	-	Valve stem seal removal

	MD998737 Valve stem seal installer	MD998737-01	Valve stem seal press-fitting
	MD998727 Oil pan FIPG cutter	MD998727-01	Engine oil pan removal
	MB991883 Flywheel stopper	General service tool	Supporting the flywheel
	MB991448 Bush remover and installer base	MB991448-01	Press-fitting the crankshaft front oil seal
	MB991454 Engine hanger balancer	MZ203827-01	
	MBMB991895		

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

ON-VEHICLE SERVICE

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 **<<A>> DRIVE BELT REMOVAL** .)

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)

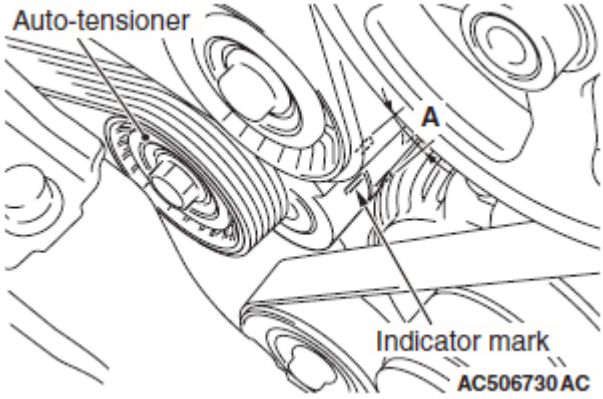


Fig. 1: Identifying Indicator Mark On Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

AUTO-TENSIONER CHECK

OPERATION CHECK

Required Special Tool:

MB992278: Belt tension release wrench

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 **<<A>> DRIVE BELT REMOVAL** .)
3. Using the special tool MB992278 and a straight offset wrench as shown, check that no binding is present by turning the auto-tensioner in the left and right directions.
4. If there are any problems in the procedure 1 or 3, replace the auto-tensioner (Refer to **<<D>> AUTO-TENSIONER REMOVAL** .)
5. Install the drive belt (Refer to **>>B<< DRIVE BELT INSTALLATION** .)

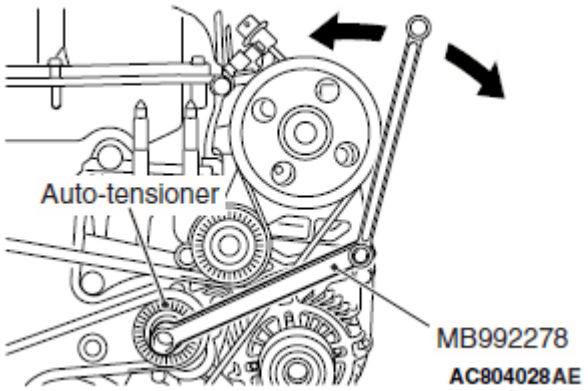


Fig. 2: Turning Auto-Tensioner Using Special Tool MB992278
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 **DRIVE BELT TENSION CHECK** .)
2. Check the tension of the drive belt in the following procedures.
   1. Connect special tool MB992082 to special tool MB992081 of special tool MB992080.
   2. Press the "POWER" button to turn on the power supply.
   3. Press 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.)

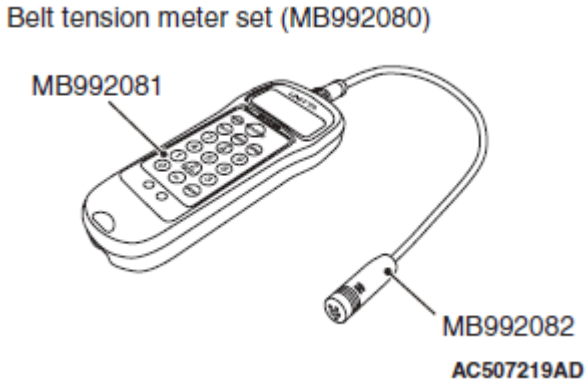


Fig. 3: Identifying Belt Tension Meter Set (MB992080)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 angle.)
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: 98 - 124 Hz

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

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

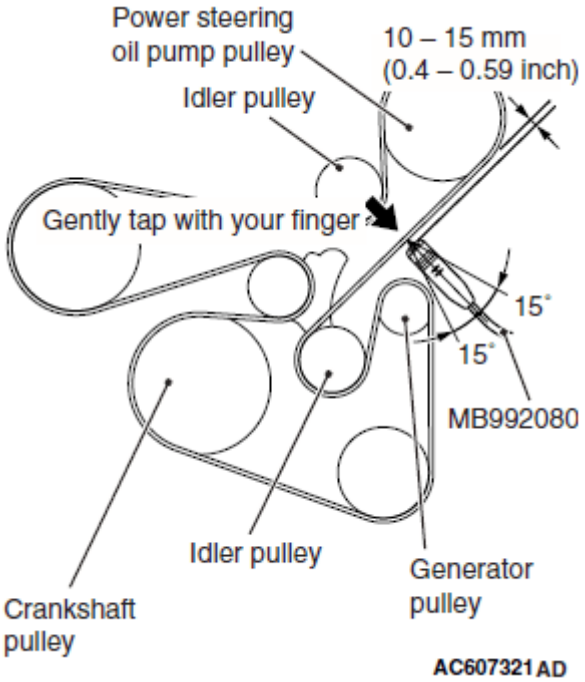


Fig. 4: Identifying Power Steering Oil Pump Pulley And Idler Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. If not within the standard value, replace the auto-tensioner (Refer to **<<D>> AUTO-TENSIONER REMOVAL** .)

<When using a tension gauge>

1. Check the tension of the drive belt (Refer to **DRIVE BELT TENSION CHECK** .)
2. Use a belt tension gauge in the middle of the belt between the pulleys shown in the illustration (at the place indicated by the arrow) 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 **<<D>> AUTO-TENSIONER REMOVAL** .)

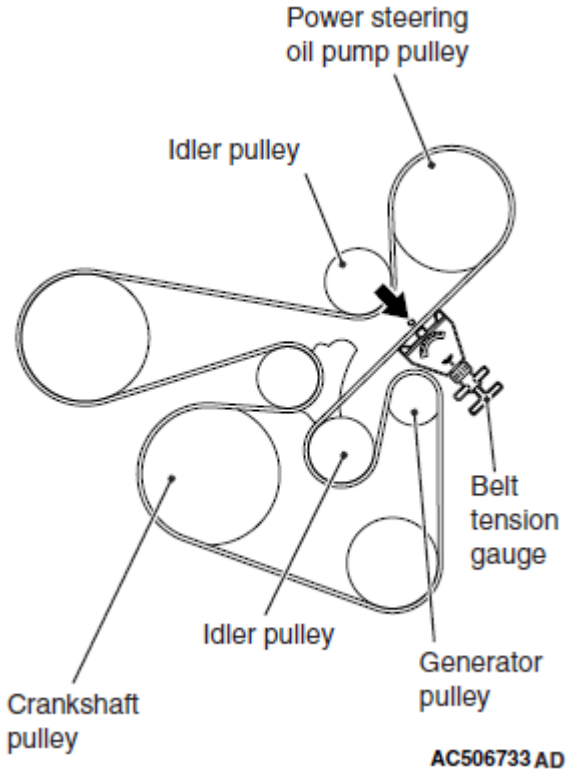


Fig. 5: Identifying Belt Tension Gauge
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

VALVE CLEARANCE CHECK AND ADJUSTMENT

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

IGNITION TIMING CHECK

Required Special Tool:

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

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

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

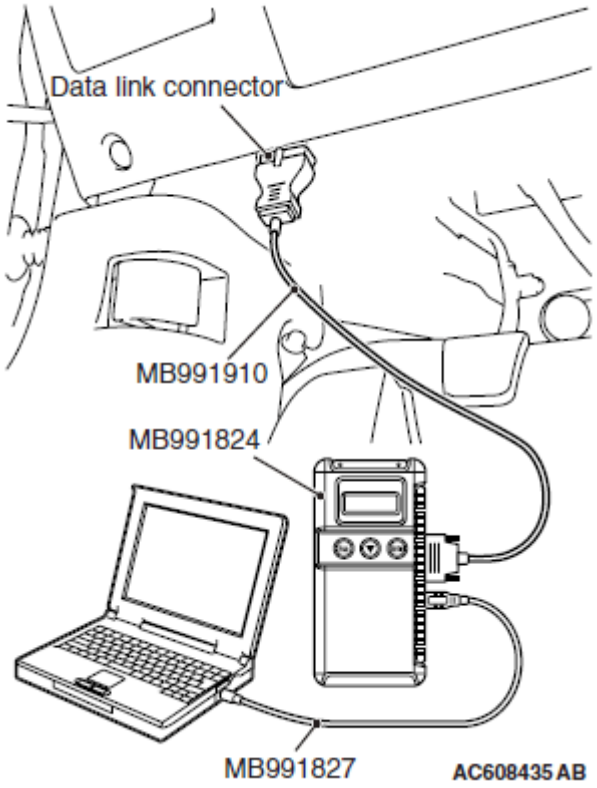


Fig. 6: Connecting Special Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   Standard value: 5° BTDC ± 3°

8. If the basic ignition timing is not within the standard value, refer to Multiport Fuel Injection (MFI) 2.0L Engine Turbo>Multiport Fuel Injection (MFI) Diagnosis - **SYMPTOM CHART** .

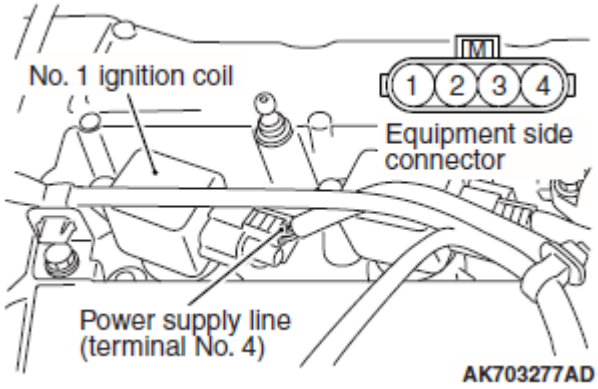


Fig. 7: Identifying Power Supply Line (Terminal No. 4) Of Ignition Coil No. 1
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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: Ignition timing fluctuates about ± 7° Before Top Dead Center, even under normal operating condition.

NOTE: It is automatically further advanced by about 5° to 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.

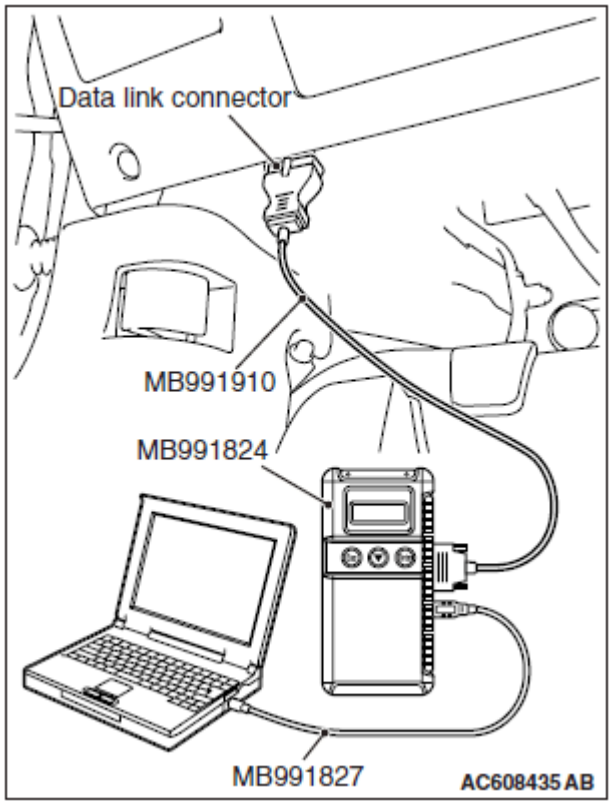


Fig. 8: Connecting Special Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 4) 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: 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.

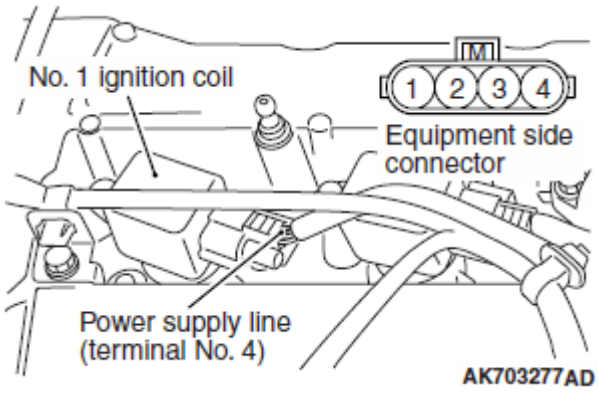


Fig. 9: Identifying Power Supply Line (Terminal No. 4) Of Ignition Coil No. 1
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Curb idle speed: 700 ± 100 r/min

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

8. If the idle speed is outside the standard value, refer to Multiport Fuel Injection (MFI) 2.0L Engine Turbo> Multiport Fuel Injection (MFI) Diagnosis - **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.

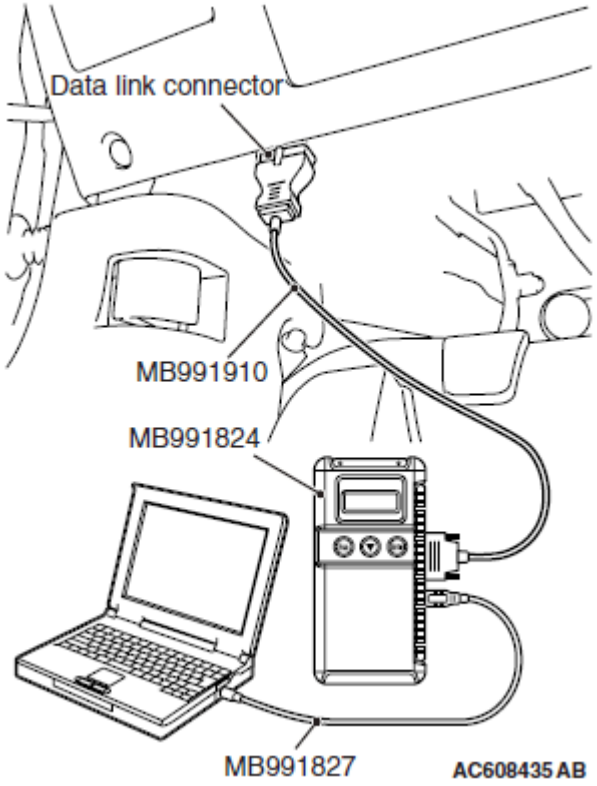


Fig. 10: Connecting Special Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Standard value: Approximately 10° BTDC

NOTE: Ignition timing fluctuates about ±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.

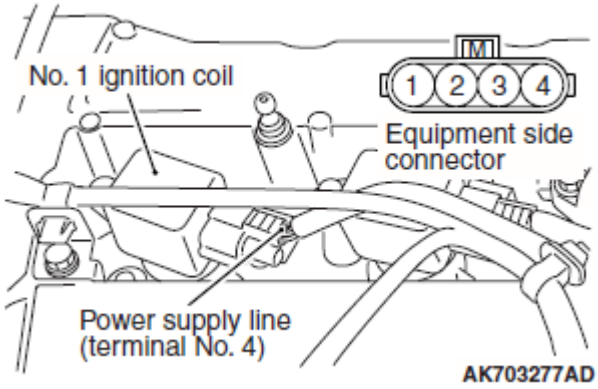


Fig. 11: Identifying Power Supply Line (Terminal No. 4) Of Ignition Coil No. 1
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   Standard value:

   CO contents: 0.5% or less

   HC contents: 100 ppm or less

9. If there is a deviation from the standard value, inspect the MFI system (Refer to Multiport Fuel Injection (MFI) 2.0L Engine Turbo> Multiport Fuel Injection (MFI) Diagnosis - **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. Disconnect the connector of the ignition coil, and then remove all the ignition coils and the 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.

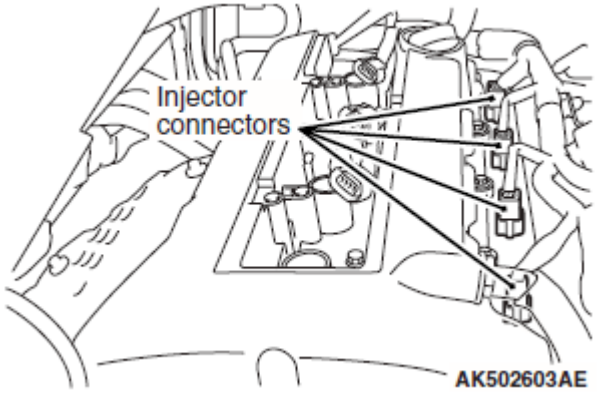


Fig. 12: Identifying Injector Connectors
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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): 1,090 kPa (158 psi)

Limit (at engine speed of 200 r/min): Minimum 750 kPa (109 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)

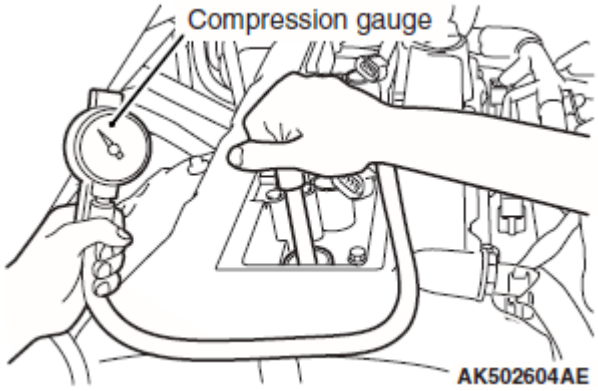


Fig. 13: Measuring Compression Pressure For Cylinders
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

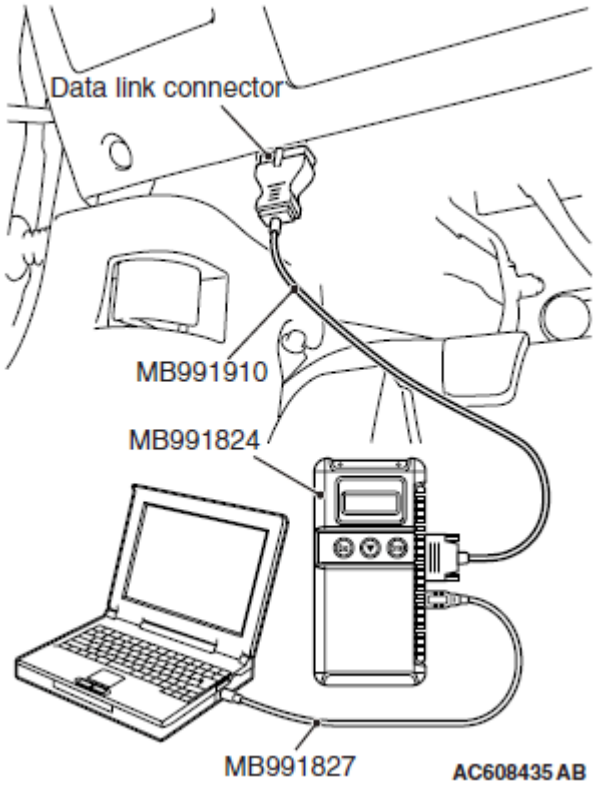


Fig. 14: Connecting Special Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

MANIFOLD VACUUM CHECK

Required Special Tool:

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

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

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

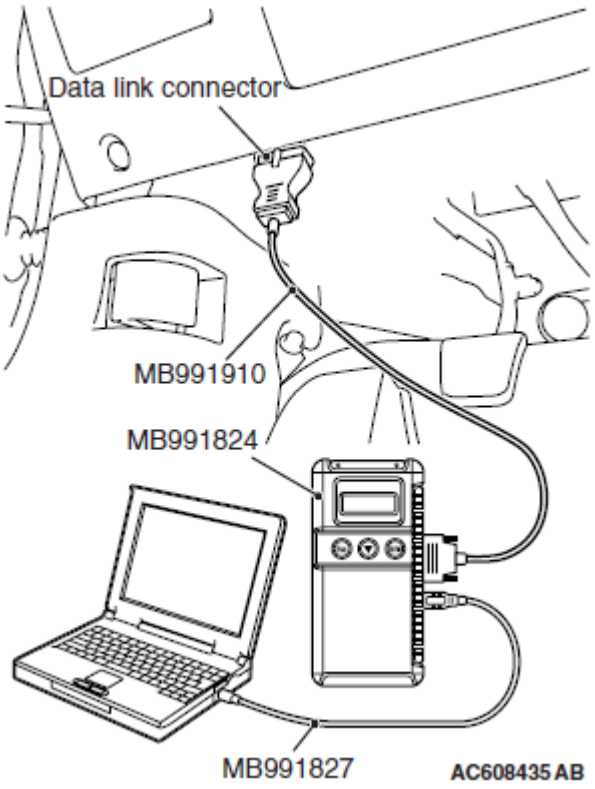


Fig. 15: Connecting Special Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

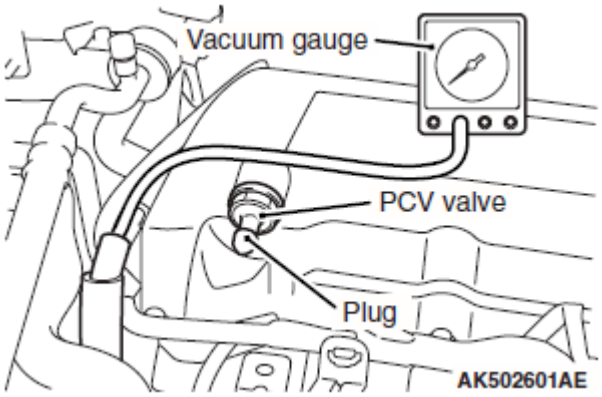


Fig. 16: Connecting Ventilation Hose To PCV Valve
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING CHAIN ELONGATION VISUAL CHECK

NOTE: When the timing chain elongates more than the specified length, the diagnostic trouble code No. P0012, variable valve timing (VVT) advanced-angle value abnormal, is set. Unless the diagnostic trouble code No. P0012, therefore, is set, the visual check is unnecessary.

NOTE: Unless the work using the following scan tool MB991958 is correctly carried out due to the malfunction of ECM, carry out the check whether or not the diagnostic trouble code exists.

- Storing the learning value regarding the amount of timing chain elongation before the ECM replacement
- Writing the learning value into the new ECM after the ECM replacement

1. Remove all the ignition coils.
2. Remove the cylinder head cover.
3. Remove the upper chain guide.

CAUTION: Always rotate the crankshaft clockwise.

4. Rotating the crankshaft clockwise, align the timing mark of camshaft sprocket with the point on the upper plane of cylinder head shown in the illustration. As a result of this, the No. 1 cylinder is positioned at the compression TDC.

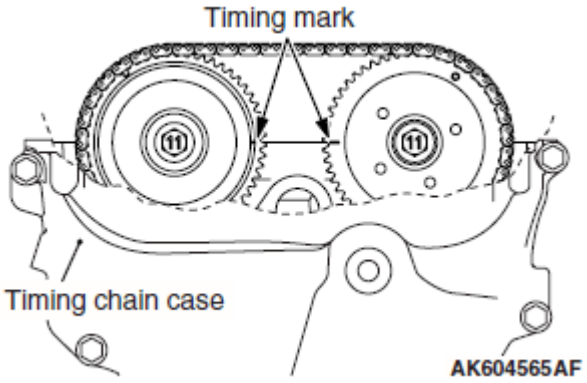


Fig. 17: Aligning Timing Mark Of Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Look at the inside of timing chain case with one eye in the direction of arrow shown in the illustration. Fix the eye line at the point where the top axis line of the chain elongation indicator at the front side of timing chain case is overlapped with that of the chain elongation indicator at the reverse side of timing chain case.

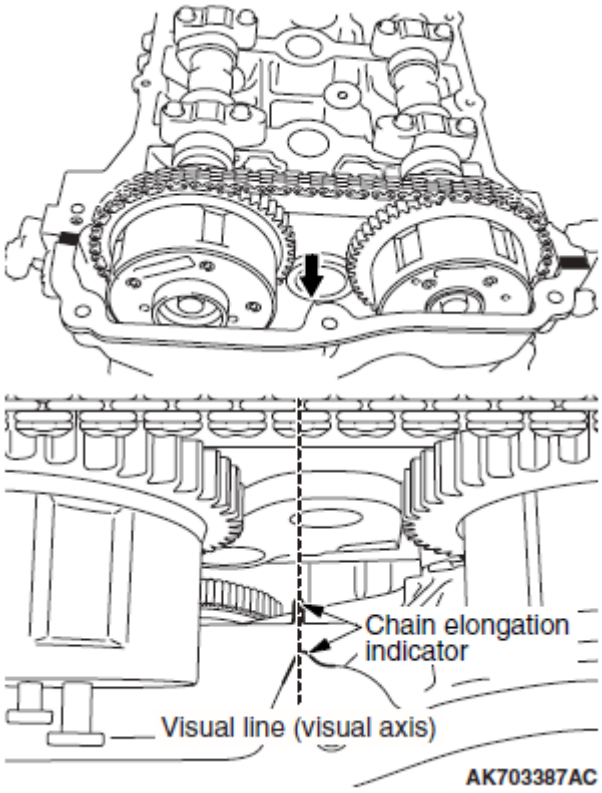


Fig. 18: Identifying Axis Line Of Chain Elongation Indicator
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Check the end top point "A" of timing chain cross section surface and the point of chain elongation indicator which is fixed in Step 5. When the end top point "A" of timing chain is positioned at the left-

hand side of chain elongation indicator, it is unnecessary to replace the timing chain because the timing chain is within the specified length. When the end top point "A" of timing chain is positioned at the right-hand side of chain elongation indicator, it is necessary to replace the timing chain because the timing chain elongates more than the specified length.

NOTE: If the timing chain is extended more than the specified value, the oil pump chain could possibly be extended, too. The oil pump chain, therefore, must be replaced when the timing chain is replaced.

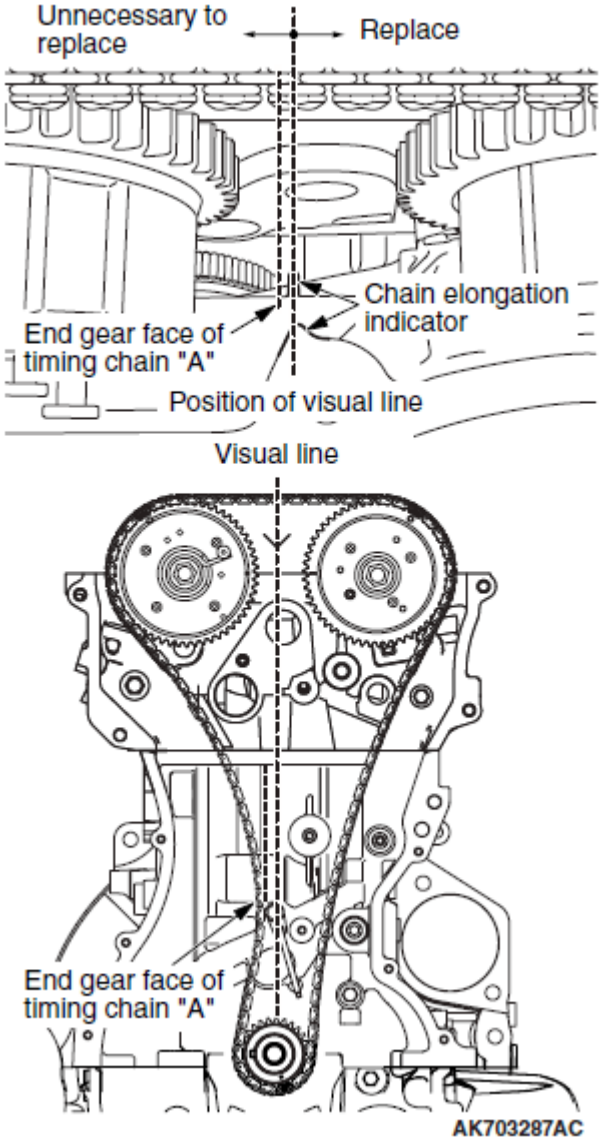


Fig. 19: Identifying Timing Chain Point (A) Of Chain Elongation Indicator
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. Install the upper chain guide.

CAUTION: Completely clean the old FIPG remaining in the clearance between the mating parts.

8. After completely removing the liquid gasket adhering on the timing chain case, cylinder block and cylinder head, degrease them with white gasoline.

CAUTION: Install the cylinder head cover within 3 minutes of applying the liquid gasket.

9. Apply a 4 mm diameter bead of liquid gasket to the point shown in the illustration.

Specified sealant: THREE BOND 1217G or equivalent

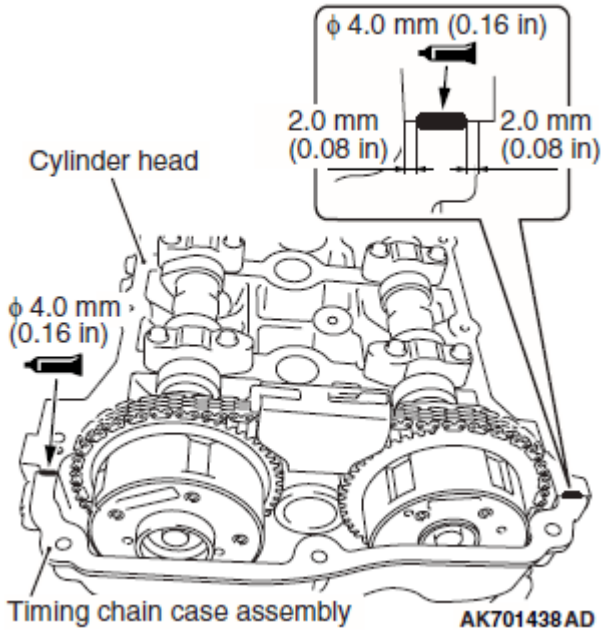


Fig. 20: Identifying Timing Chain Case Assembly And Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

10. Installing the cylinder head cover, tighten the tightening bolt according to the following procedures.
    a. Temporarily tighten the tightening bolt in the order shown in the illustration.

       Tightening torque: 3.0 ± 1.0 N.m

    b. Tighten the tightening bolt to the specified torque in the order shown in the illustration.

       Tightening torque: 5.5 ± 0.5 N.m

11. Install the ignition coil.
12. Use the scan tool MB991958 to select the timing chain maintenance. Initialize the learning value. Refer to

TIMING CHAIN MAINTENANCE .

NOTE: Carry out the initialization even if the amount of timing chain elongation is normal. As a result of this, it is necessary to replace the timing chain before the timing chain interferes with the other components when the next warning lamp illuminates or the diagnostic trouble code No. P0012 is set.

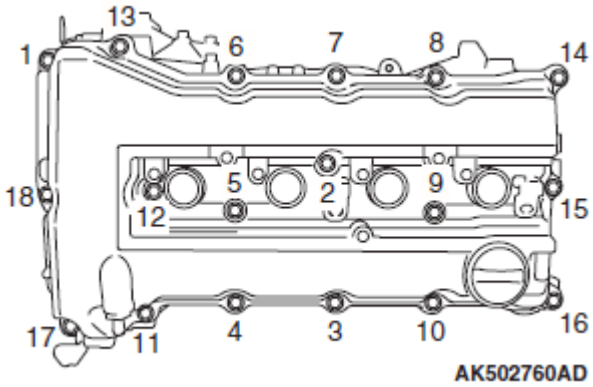
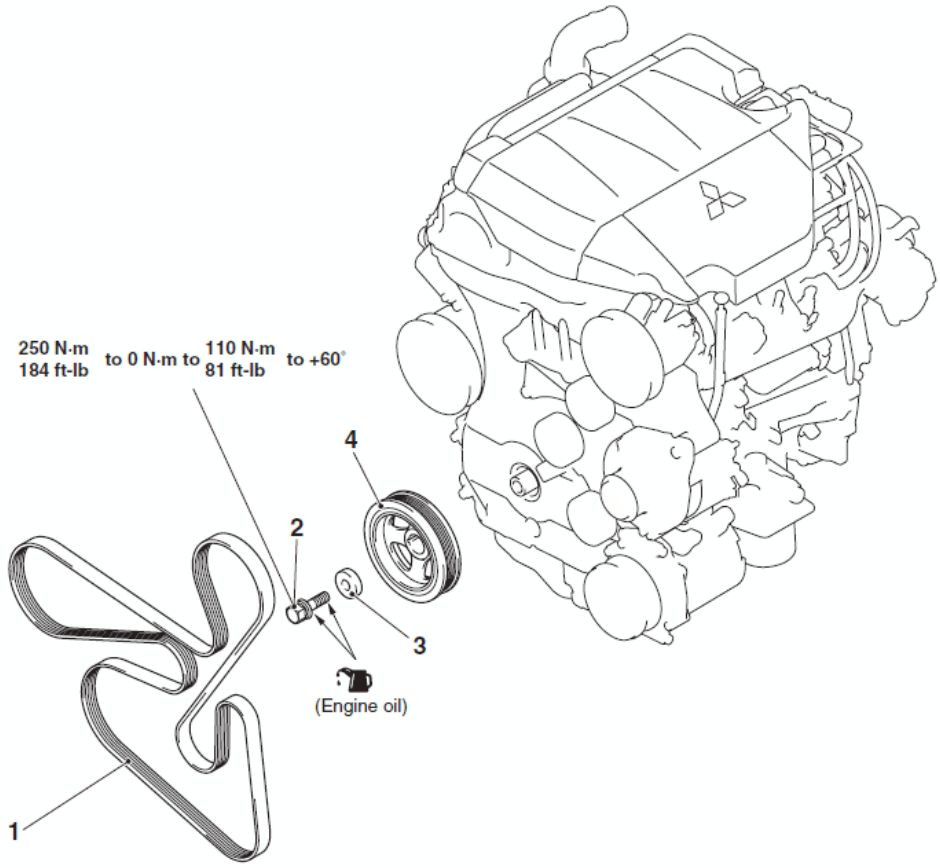


Fig. 21: Identifying Cylinder Head Cover Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

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



			Removal steps
<<A>>	>>B<<	1.	Drive belt
<<B>>	>>A<<	2.	Crankshaft pulley center bolt
<<B>>	>>A<<	3.	Crankshaft pulley washer

		Removal steps (Continued)
	•	Engine mounting bracket
>>A<<	4.	Crankshaft pulley

Fig. 22: Identifying Crankshaft Pulley Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB992278: Belt Tension Release Wrench
- MB990767: Front Hub and Flange Yoke Holder
- MD 998719: Pin

REMOVAL SERVICE POINTS

<<A>> DRIVE BELT REMOVAL

Since the serpentine drive system with the auto-tensioner is used, 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 special tool MB992278 and insert the L-shaped hexagon wrench into the auto-tensioner hole to fix the auto-tensioner.
2. Remove the drive belt.

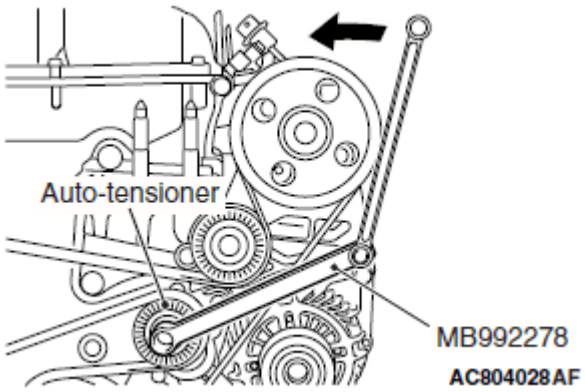


Fig. 23: Rotating Pulley Bolt Of Auto-Tensioner With Special Tool MB992278
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

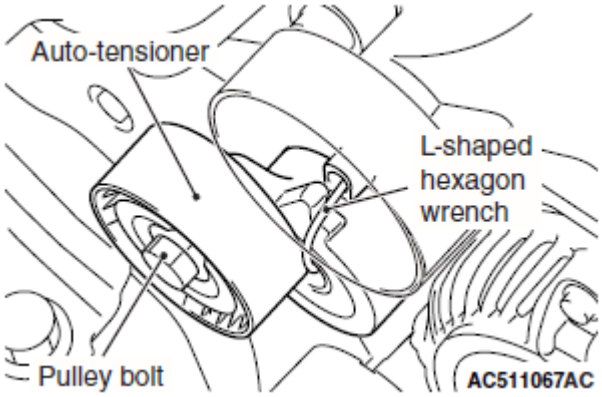


Fig. 24: Identifying Auto-Tensioner, Pulley Bolt And L-Shaped Hexagon Wrench
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> 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.

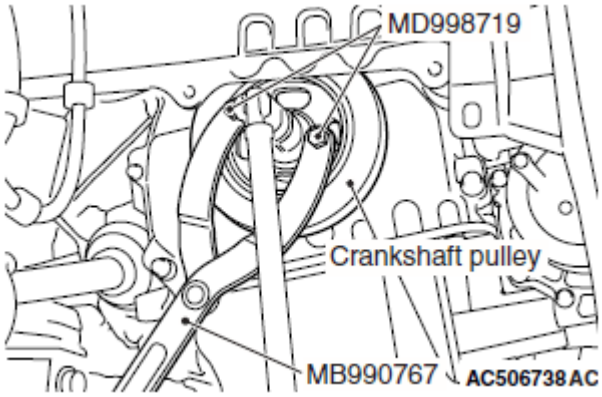


Fig. 25: Removing Crankshaft Pulley Center Bolt And Crankshaft Pulley Washer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

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

1. Wipe off the dirt on the crankshaft and crankshaft pulley as shown in the illustration using a rag.
2. Wipe off the dirt on the crankshaft sprocket, crankshaft and crankshaft pulley as shown in the illustration 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 crankshaft pulley center bolt as shown in the illustration using a rag.
5. Apply an adequate and minimum amount of engine oil to the threads of the crankshaft pulley center bolt and lower area of the flange.

∘ : Wipe clean with a rag.
✳ : Wipe clean with a rag and degrease.
• : Apply a small amount of engine oil.

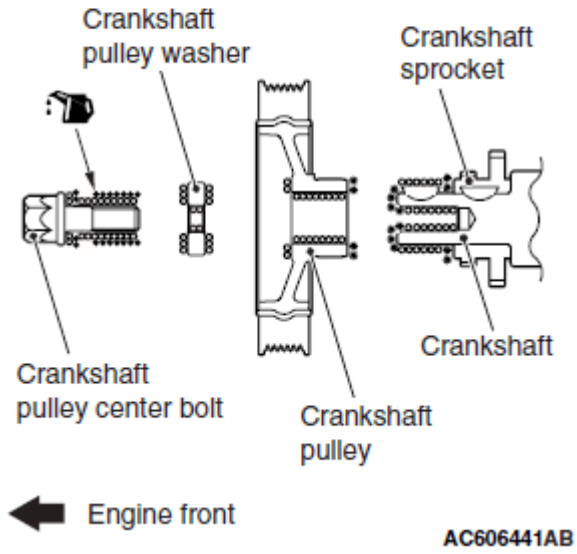


Fig. 26: Identifying Crankshaft Pulley Center Bolt And Crankshaft Pulley Washer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

       Tightening torque: 250 N.m (184 ft-lb)

    2. Loosen the crankshaft pulley center bolt fully.
    3. Tighten the crankshaft pulley center bolt again to the specified torque.

       Tightening torque: 110 N.m (81 ft-lb)

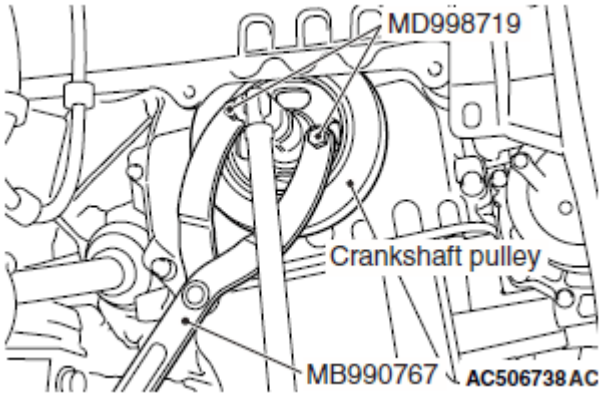


Fig. 27: Removing Crankshaft Pulley Center Bolt And Crankshaft Pulley Washer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. As shown in the illustration "A," apply the paint mark to the crankshaft pulley on the extended line of the corner adjacent to the one of the crankshaft pulley center bolt corners.

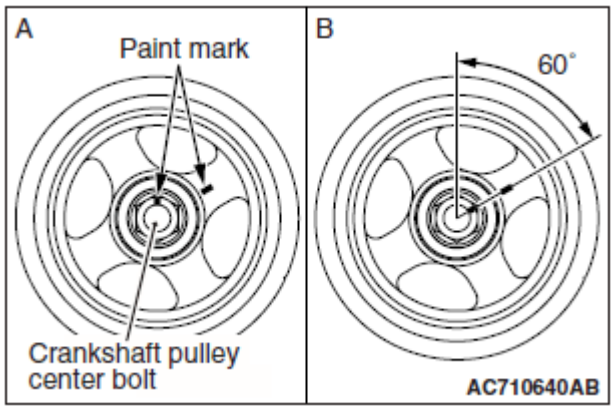


Fig. 28: Identifying Crankshaft Pulley Center Bolt And Paint Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

5. Tighten the crankshaft pulley center bolt by 60 degrees angle once more. Make sure the paint mark of crankshaft pulley center bolt is aligned with the paint mark of crankshaft pulley as shown in the illustration "B."

>>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.**

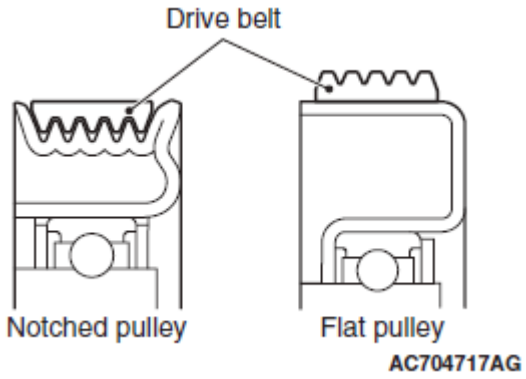


Fig. 29: Identifying Drive Belt Of Flat Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

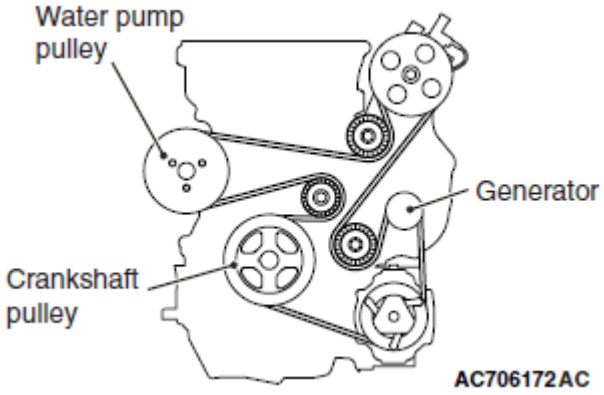


Fig. 30: Identifying Drive Belt To Pulleys
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Set an special tool MB992278 to the pulley bolt of the auto-tensioner. Then, rotate the auto-tensioner counterclockwise 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.

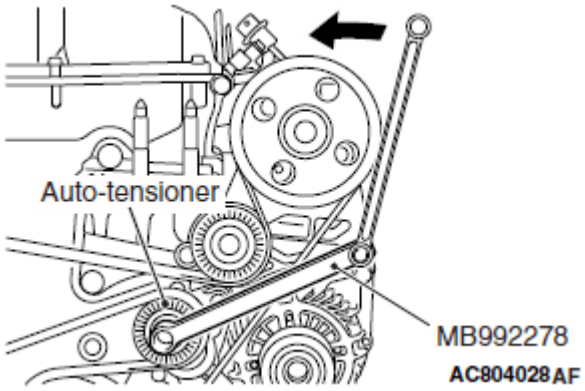


Fig. 31: Rotating Pulley Bolt Of Auto-Tensioner With Special Tool MB992278
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

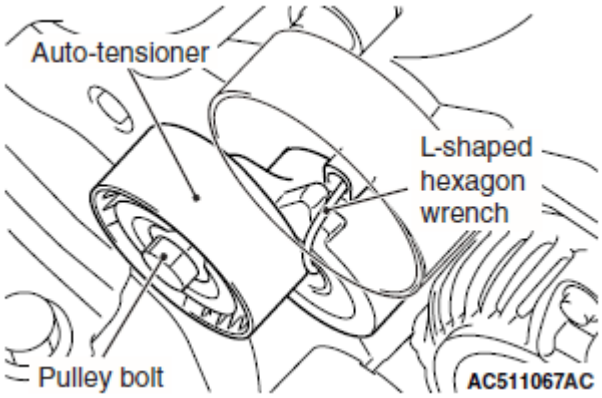
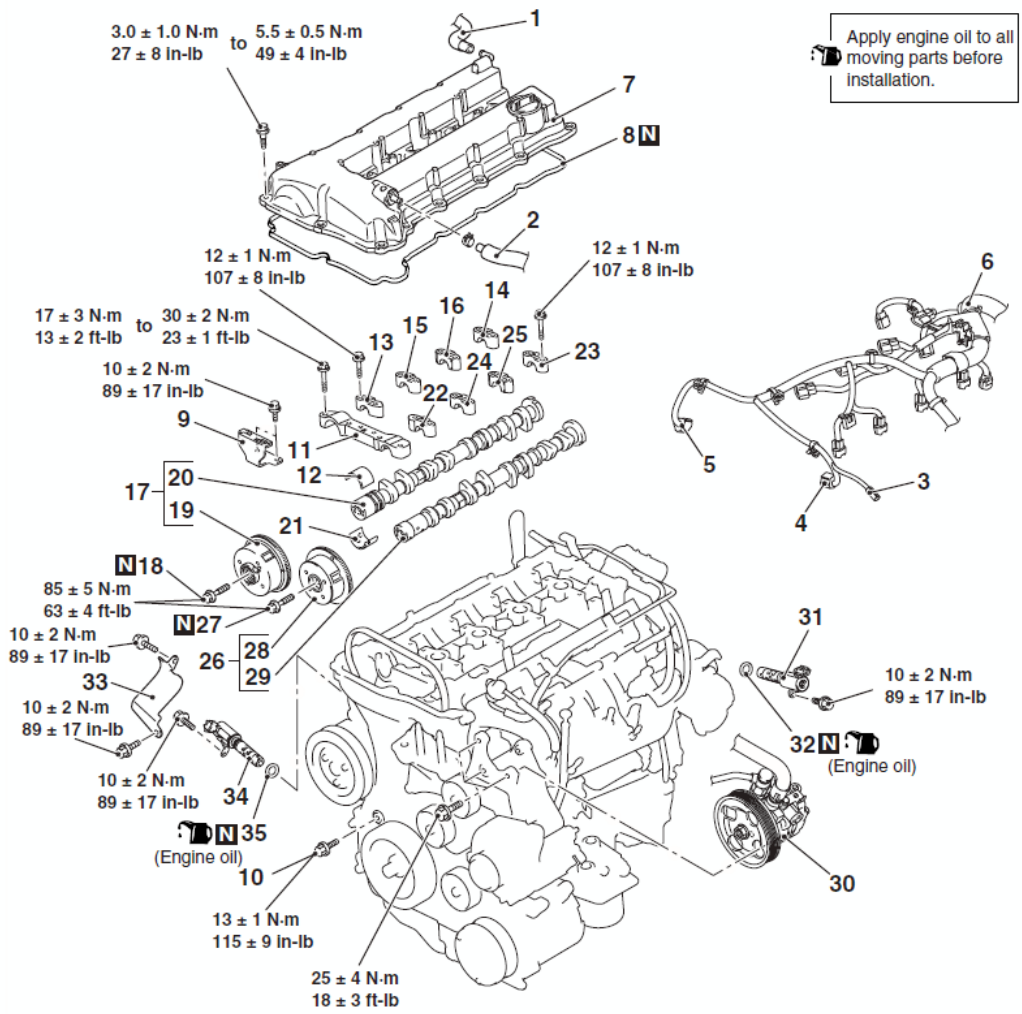


Fig. 32: Identifying Auto-Tensioner, Pulley Bolt And L-Shaped Hexagon Wrench
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 • Charge Air Cooler Intake Hose A Removal • Strut Tower Bar Removal • Ignition Coil Removal	• Ignition Coil Installation • Strut Tower Bar Installation • Charge Air Cooler Intake Hose A Installation • Air Cleaner Assembly Installation • Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation



AC708206AC

Camshaft removal steps

1. Breather hose connection
2. PCV hose connection
3. Power steering fluid pressure switch connector connection
4. Intake oil feeder control valve connector connection
5. Exhaust oil feeder control valve connector connection
6. Control harness connection

<<A>> >>G<< 7. Rocker cover assembly
8. Rocker cover gasket

<<B>>

Camshaft removal steps

- Number 1 cylinder compression top dead center setting (only at removal.)
- Valve clearance adjustment (only at installation.)

9. Timing chain upper guide
10. Service hole bolt

<<C>>

- Camshaft and camshaft sprocket assembly (exhaust side) removal preparatory operation (only at removal.)

<<D>> >>F<< 11. Front camshaft bearing cap

Fig. 33: Identifying Camshaft Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

		Camshaft removal steps
	>>E<<	12. Camshaft bearing
<<E>>	>>D<<	13. Oil feeding camshaft bearing cap (exhaust side)
<<E>>	>>D<<	14. Camshaft bearing cap (exhaust side)
<<E>>	>>D<<	15. Camshaft bearing cap (exhaust side)
<<E>>	>>D<<	16. Thrust camshaft bearing cap (exhaust side)
<<F>>	>>E<<	17. Camshaft and camshaft sprocket assembly (exhaust side)
<<G>>	>>B<<	18. Camshaft sprocket bolt
<<G>>	>>B<<	19. Camshaft sprocket (exhaust side)
<<G>>	>>B<<	20. Camshaft (exhaust side)
	>>E<<	21. Camshaft bearing
<<E>>	>>D<<	22. Oil feeding camshaft bearing cap (intake side)
<<E>>	>>D<<	23. Camshaft bearing cap (intake side)
<<E>>	>>D<<	24. Camshaft bearing cap (intake side)
<<E>>	>>D<<	25. Thrust camshaft bearing cap (intake side)
	>>C<<	26. Camshaft and camshaft sprocket assembly (intake side)
<<G>>	>>B<<	27. Camshaft sprocket bolt
<<G>>	>>B<<	28. Camshaft sprocket (intake side)
<<G>>	>>B<<	29. Camshaft (intake side)
		Intake oil feeder control valve removal steps
		4. Intake oil feeder control valve connector connection
		• Drive belt
<<H>>		30. Power steering oil pump assembly
<<I>>	>>A<<	31. Intake oil feeder control valve
	>>A<<	32. O-ring
		Exhaust oil feeder control valve removal steps
		5. Exhaust oil feeder control valve connector connection
		33. Exhaust oil feeder control valve heat protector
<<I>>	>>A<<	34. Exhaust oil feeder control valve
	>>A<<	35. O-ring

Fig. 34: Identifying Camshaft Components (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MB992103: Chain Tension Release Bar

REMOVAL SERVICE POINTS

<<A>> ROCKER COVER ASSEMBLY REMOVAL

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

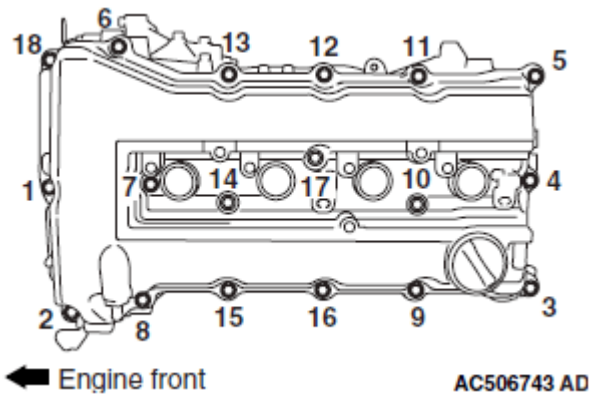


Fig. 35: Identifying Rocker Cover Assembly Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

CAUTION: Never turn the crankshaft counterclockwise.

1. Turn the crankshaft clockwise so that the camshaft sprocket timing marks become horizontal to the cylinder head upper surface, and set the number 1 cylinder to the top dead center of compression. At this time, check that the crankshaft pulley timing mark is in the 0-degree angle 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.)

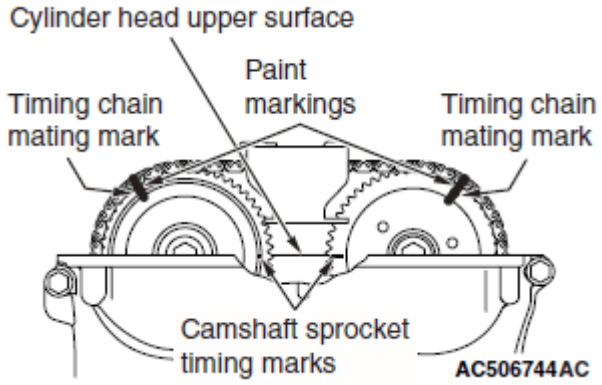


Fig. 36: Identifying Camshaft Sprocket Timing Chain Mating Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

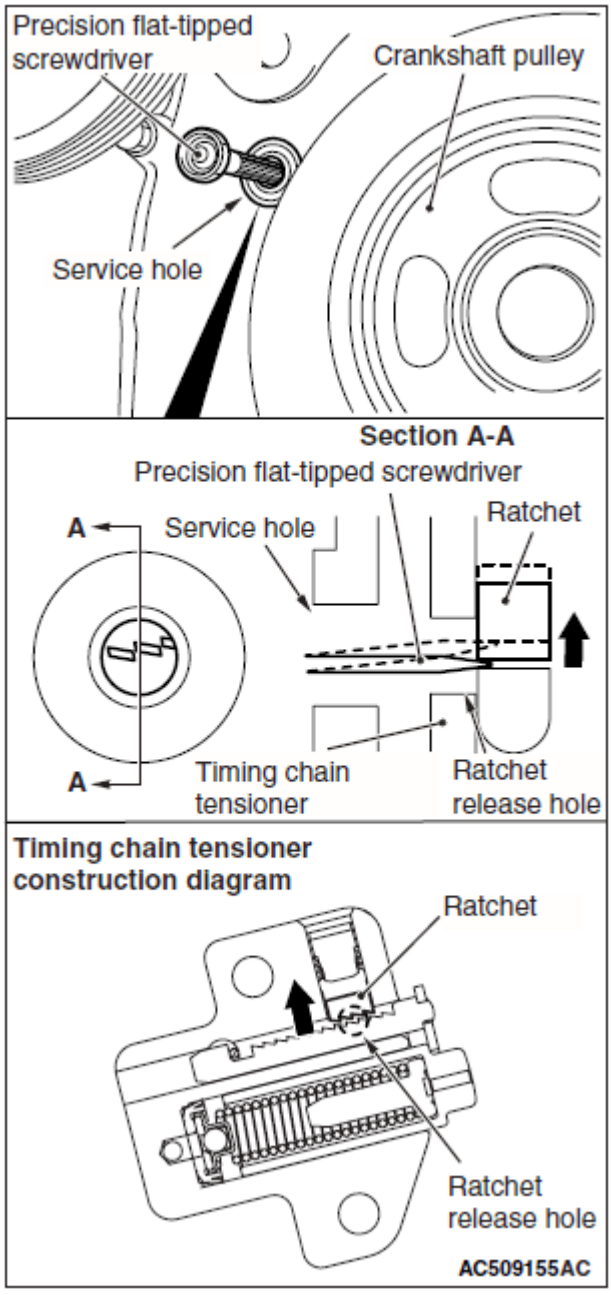


Fig. 37: Inserting Precision Flat-Tipped Screwdriver Through Service Hole Of Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 MB992103 beyond its insertion guideline.**
- **If unlocking the timing chain tensioner is insufficient, the**

special tool MB992103 cannot be inserted to the insertion guideline. Do not insert the special tool MB992103 forcibly, follow Step 1 again to unlock the timing chain tensioner and insert the special tool MB992103.

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 (**Fig. 39**.)

NOTE: With the timing chain tensioner unlocked, insert the special tool MB992103 along the tension side of the timing chain, according to the special tool MB992103 top shape. The special tool MB992103 can be inserted smoothly to the position where the special tool MB992103 insertion guide line aligns with the timing chain case assembly top surface (Fig. 39), and the spread timing chain tension side guide can be held (Fig. 39.)

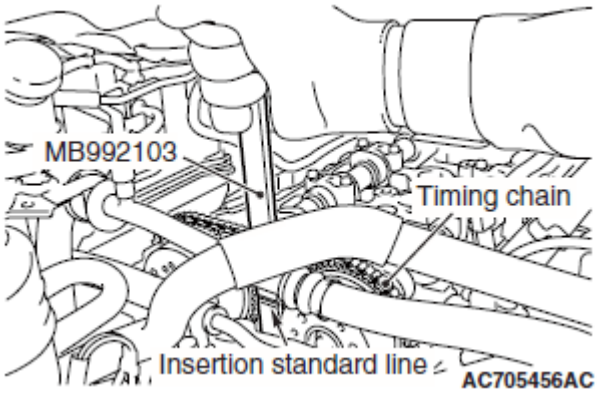


Fig. 38: Inserting Timing Chain Case Assembly Using Special Tool MB992103
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. With the special tool MB992103 inserted up to the insertion guide line, press the special tool MB992103 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.

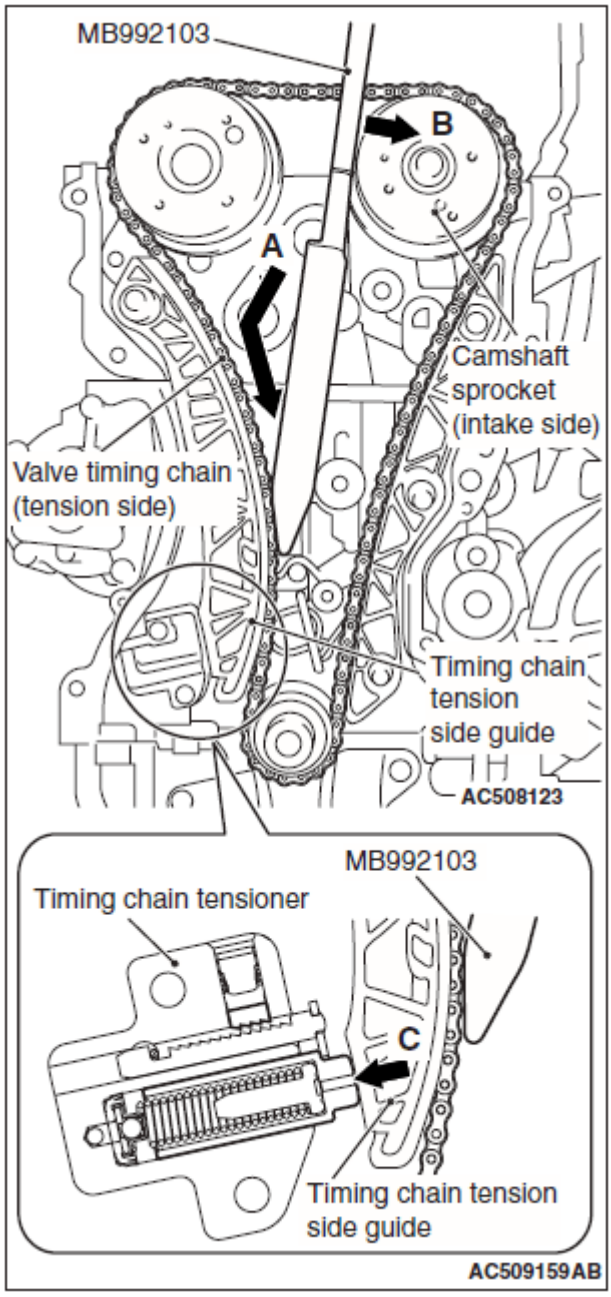


Fig. 39: Removing Flat-Tipped Precision Screwdriver Unlocking Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 MB992103 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.

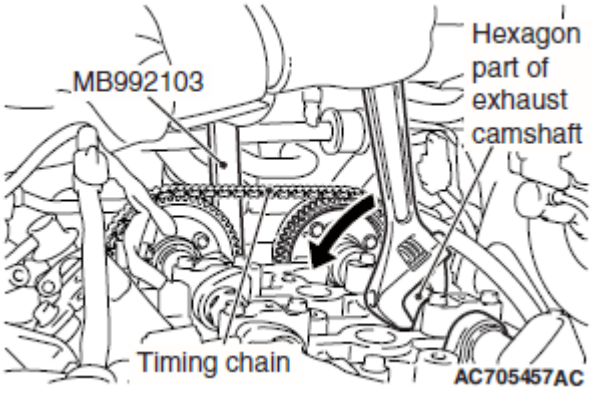


Fig. 40: Identifying Timing Chain To Camshaft Sprockets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<D>> FRONT CAMSHAFT BEARING CAP REMOVAL

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

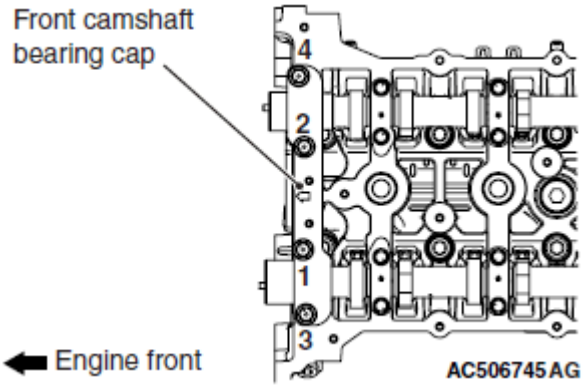


Fig. 41: Identifying Front Camshaft Bearing Cap Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

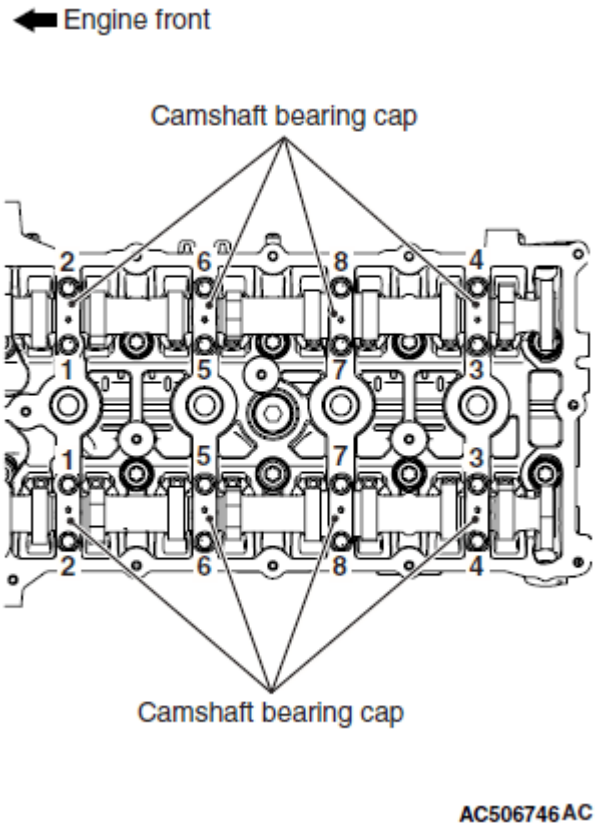


Fig. 42: Identifying Camshaft Bearing Cap Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

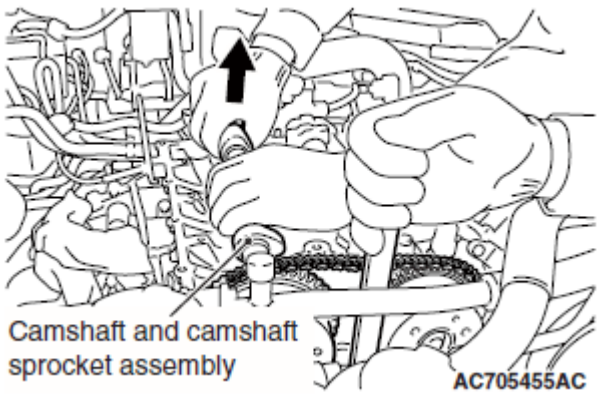


Fig. 43: Removing Camshaft And Camshaft Sprocket Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

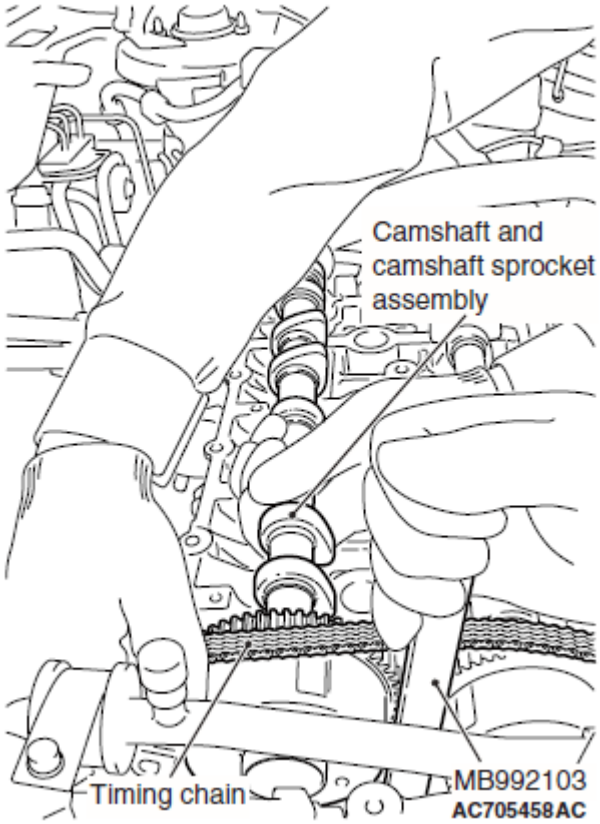


Fig. 44: Removing Timing Chain From Camshaft And Camshaft Sprocket Assembly (Exhaust Side)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

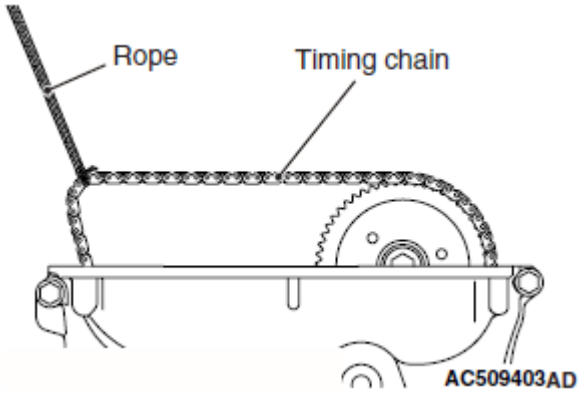


Fig. 45: Identifying Rope And Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<G>> CAMSHAFT SPROCKET BOLT/CAMSHAFT SPROCKET/CAMSHAFT REMOVAL

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

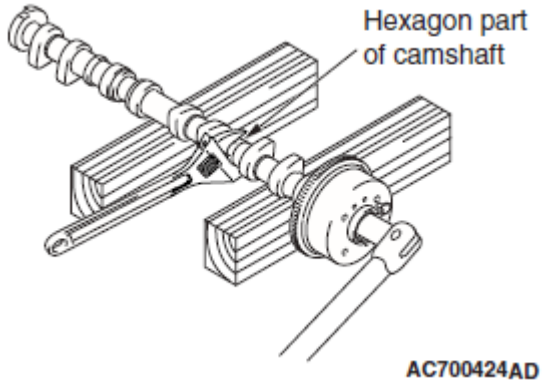


Fig. 46: Removing Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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 feed 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 feeder control valve, be careful to avoid damage to the O-ring.

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

>>B<< CAMSHAFT/CAMSHAFT SPROCKET/CAMSHAFT SPROCKET BOLT INSTALLATION

CAUTION: The camshaft sprocket bolt cannot be reused.

Install the camshaft and camshaft sprocket assembly as follows.

1. Check that the knock pin is set to the right overhead position.
2. an adequate and minimum amount of engine oil to the outer of the camshaft edge and the entire insertion area around camshaft sprocket assembly.
3. Set the knock pin hole of camshaft sprocket assembly to the right overhead position, and slowly insert it into the camshaft assembly to the specified position.
4. Install the camshaft sprocket to the camshaft.
5. Apply an adequate and minimum amount of engine oil to the thread of the camshaft sprocket bolt and the lower area of the flange.

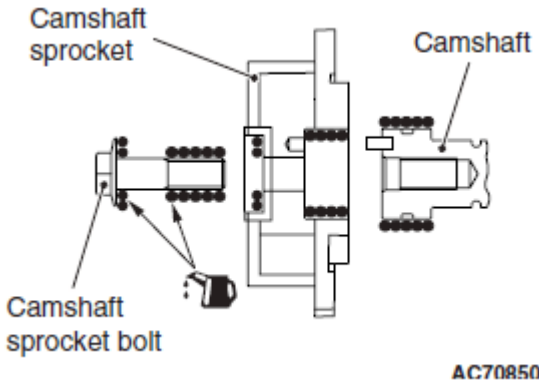


Fig. 47: Identifying Camshaft Sprocket And Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Clamp the hexagon part of the camshaft and fix it in the same manner as removal.
7. Tighten the camshaft sprocket bolt to the specified torque.

Tightening torque: 85 ± 5 N.m (63 ± 4 ft-lb)

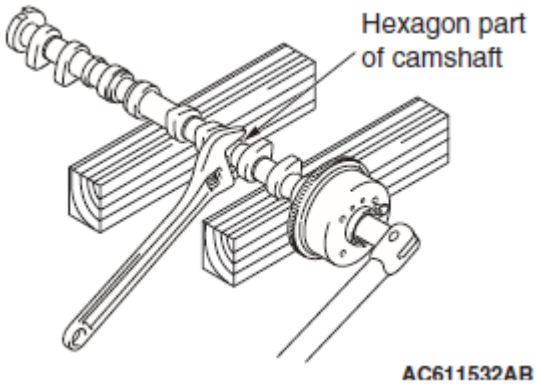


Fig. 48: Removing Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

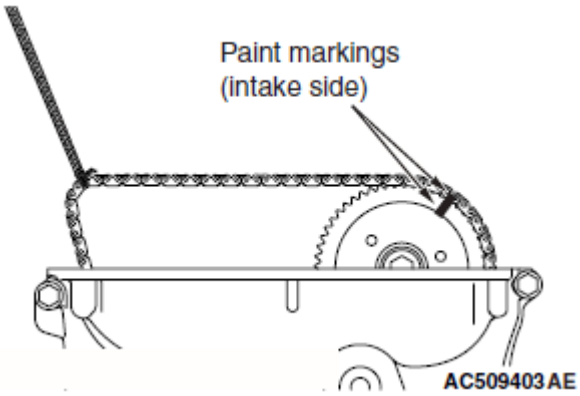


Fig. 49: Identifying Intake Side Paint Mark Of Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 head.

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 bolts to the specified torque in the order of number shown in the illustration in two or three steps.

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

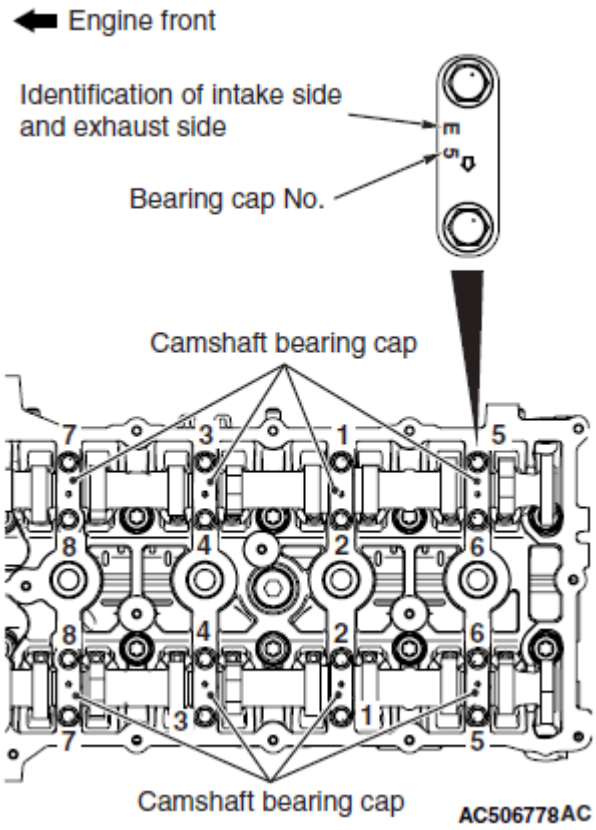


Fig. 50: Identifying Camshaft Bearing Cap Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 cap deviate from its position.**

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 on the place shown in the illustration.

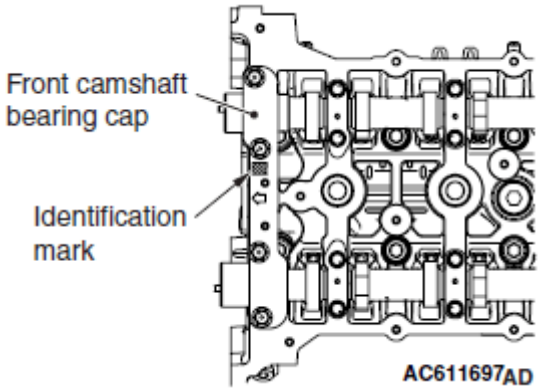


Fig. 51: Identifying Front Camshaft Bearing Cap And Identification Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

FRONT CAMSHAFT BEARING CAP SPECIFICATION CHART

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

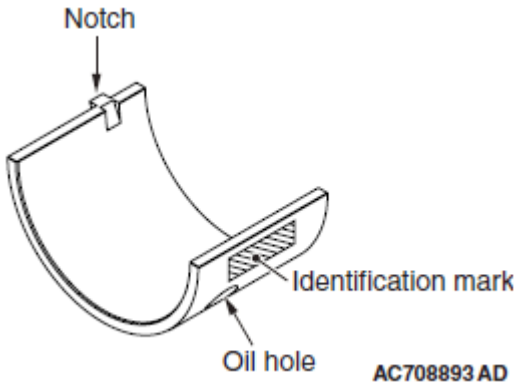


Fig. 52: Identifying Front Camshaft Bearing Identification Mark And Oil Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

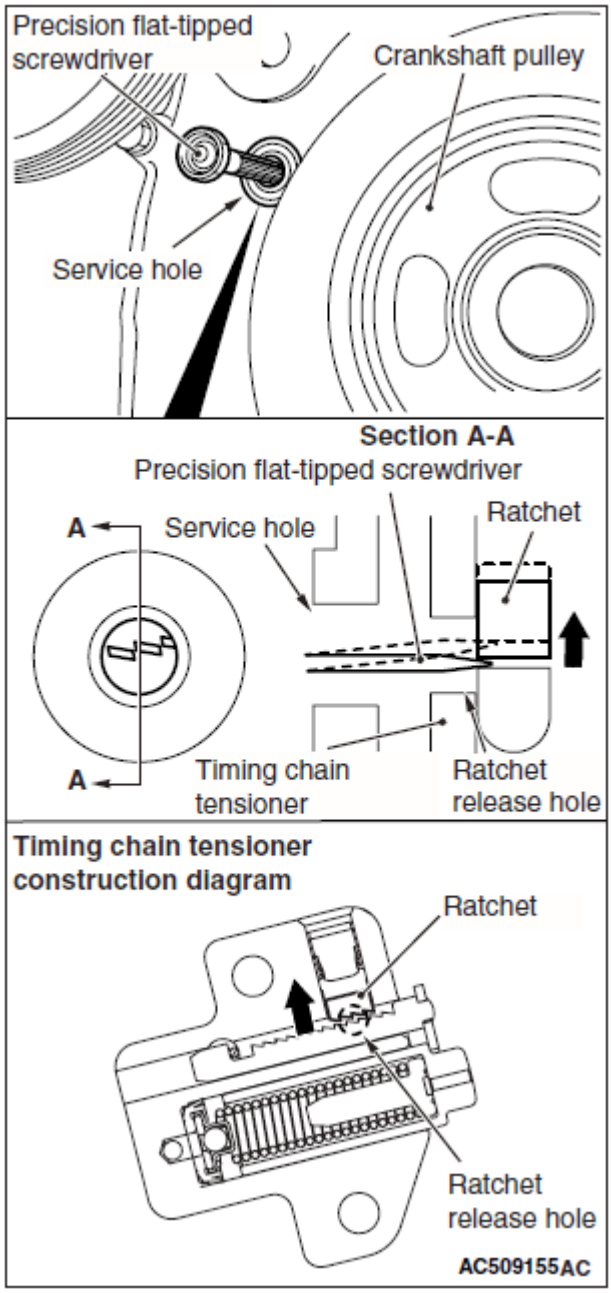


Fig. 53: Inserting Precision Flat-Tipped Screwdriver Through Service Hole Of Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 MB992103 beyond its insertion guideline.**
- **If unlocking the timing chain tensioner is insufficient, the**

special tool MB992103 cannot be inserted to the insertion guideline. Do not insert the special tool MB992103 forcibly, follow Step 2 again to unlock the timing chain tensioner and insert the special tool MB992103.

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 (**Fig. 55**.)

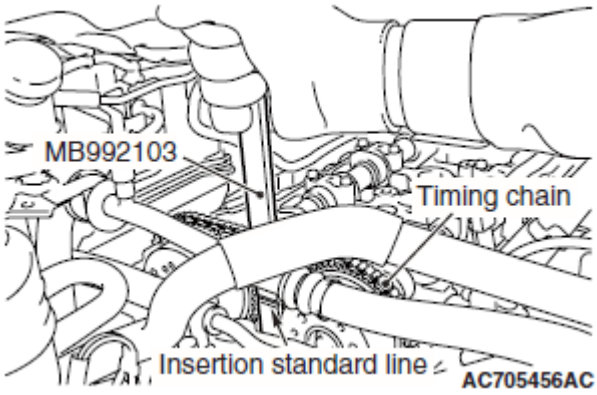


Fig. 54: Inserting Timing Chain Case Assembly Using Special Tool MB992103
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: With the timing chain tensioner unlocked, insert the special tool MB992103 along the tension side of the timing chain, according to the special tool MB992103 top shape. The special tool MB992103 can be inserted smoothly to the position where the special tool MB992103 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 MB992103 against the intake side camshaft sprocket (**Fig. 55**) and spread and hold the timing chain tension side guide (**Fig. 55**.)
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 (**Fig. 55**) to provide allowance for easy installation of the camshaft and camshaft sprocket assembly (exhaust side) to the timing chain.

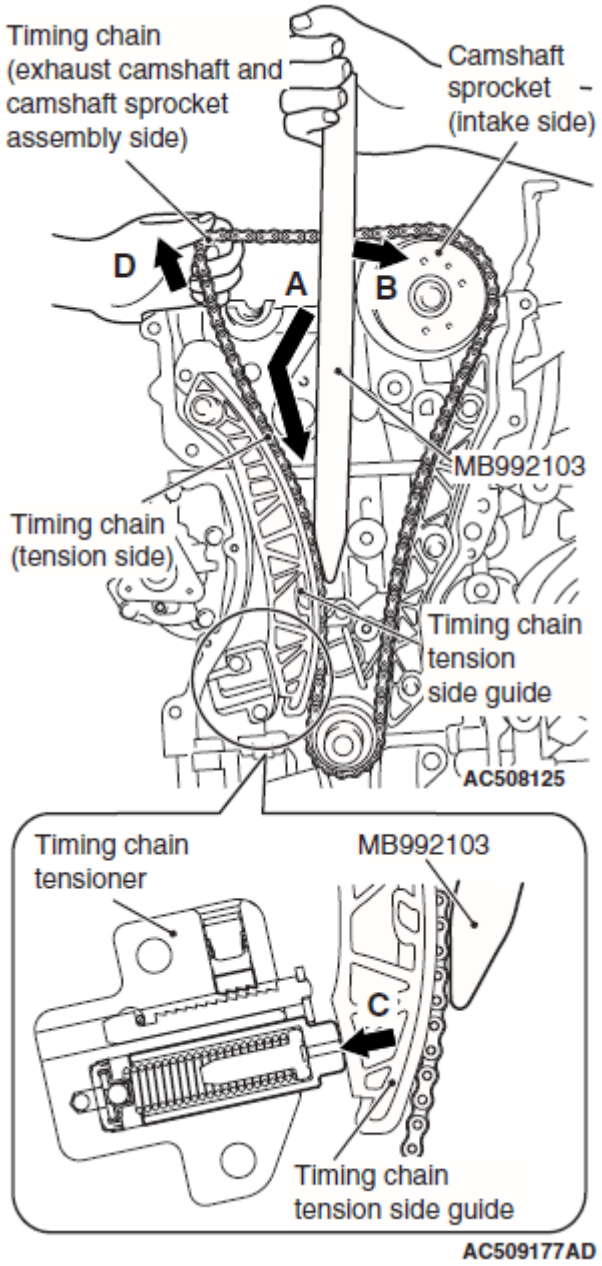


Fig. 55: Removing Flat-Tipped Precision Screwdriver Unlocking Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 MB992103 inserted into the timing chain case assembly inside.

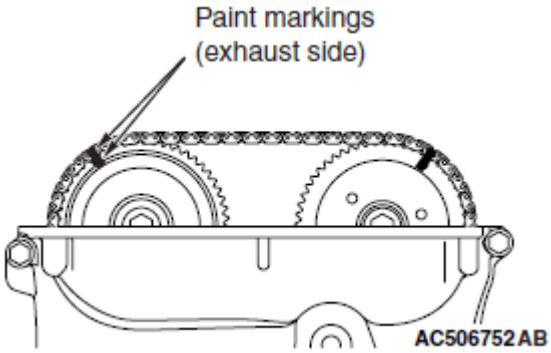


Fig. 56: Identifying Exhaust Side Paint Mark Of Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< FRONT CAMSHAFT BEARING CAP 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 mounting bolts 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 mounting bolts 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 0-degree angle position of ignition timing indicator are aligned respectively.

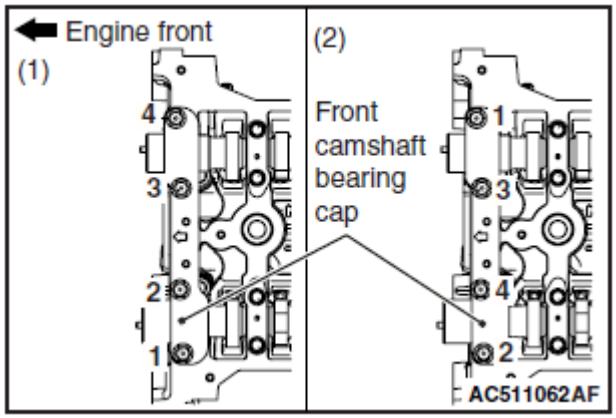


Fig. 57: Identifying Front Camshaft Bearing Cap Mounting Bolts Tightening Sequence

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 cylinder head and timing chain case assembly, and degrease the surface where the sealant is applied.

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

2. Apply sealant to the joint between the cylinder head and timing chain case assembly as shown in the illustration and install the rocker cover assembly to the cylinder head.

   Specified sealant: Three bond 1217G or equivalent

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

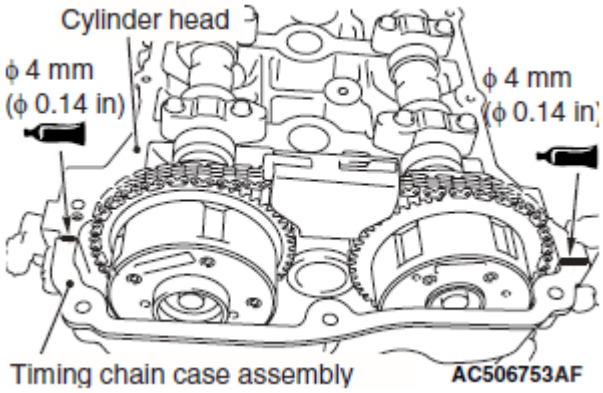


Fig. 58: Identifying Timing Chain Case Assembly And Cylinder Head To Sealant Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

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

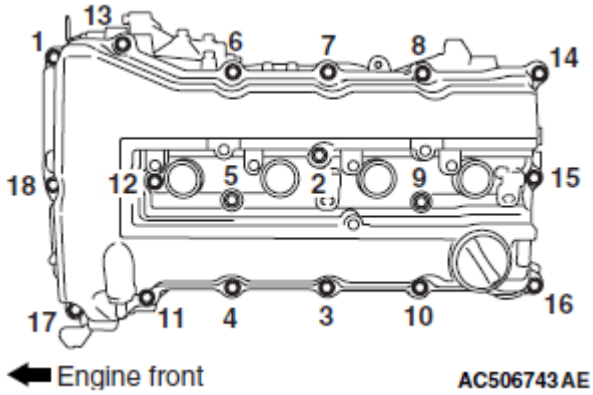


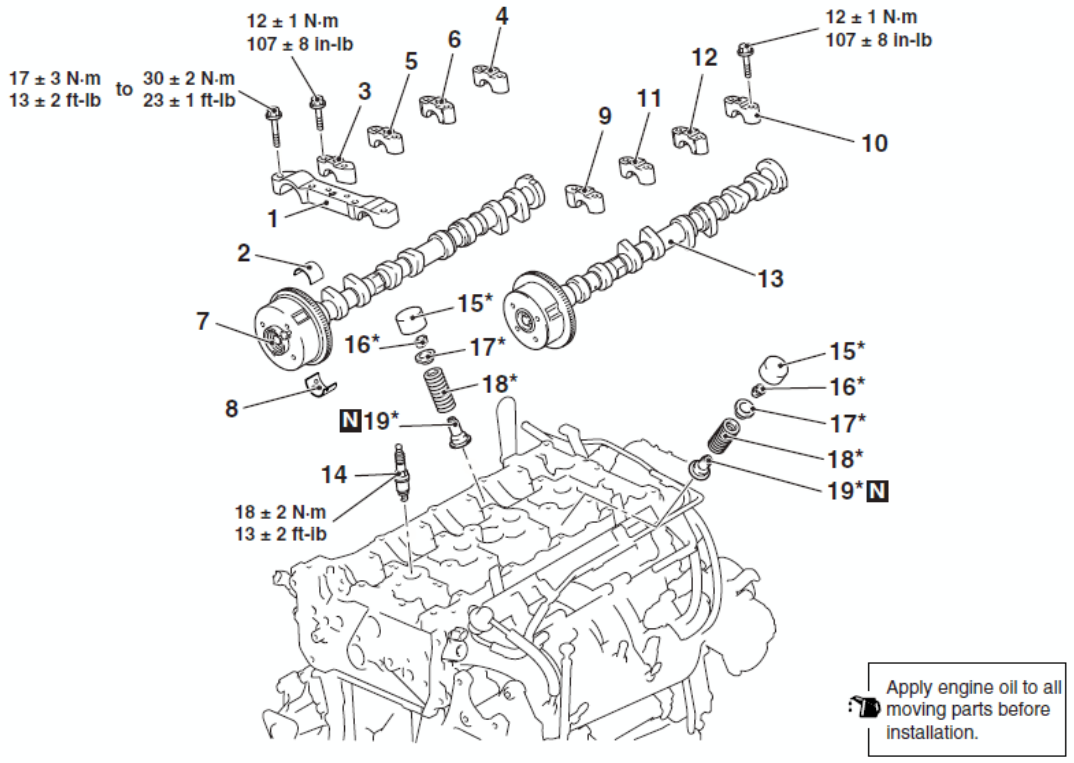
Fig. 59: Identifying Rocker Cover Assembly Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 A, 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 A, B and Engine Room Side Cover (RH) Installation



Removal steps

<<A>>	>>G<<	1.	Front camshaft bearing cap
	>>F<<	2.	Camshaft bearing
<<B>>	>>E<<	3.	Oil feeding camshaft bearing cap (exhaust side)
<<B>>	>>E<<	4.	Camshaft bearing cap (exhaust side)
<<B>>	>>E<<	5.	Camshaft bearing cap (exhaust side)
<<B>>	>>E<<	6.	Thrust camshaft bearing cap (exhaust side)
	>>F<<	7.	Camshaft and camshaft sprocket assembly (exhaust side)
	>>F<<	8.	Camshaft bearing
<<B>>	>>E<<	9.	Oil feeding camshaft bearing cap (intake side)
<<B>>	>>E<<	10.	Camshaft bearing cap (intake side)
<<B>>	>>E<<	11.	Camshaft bearing cap (intake side)
<<B>>	>>E<<	12.	Thrust camshaft bearing cap (intake side)

Removal steps (Continued)

		13.	Camshaft and camshaft sprocket assembly (intake side)
		14.	Spark plug
<<C>>	>>D<<	15.	Valve tappet
<<D>>	>>C<<	16.	Valve spring retainer lock
		17.	Valve spring retainer
	>>B<<	18.	Valve spring
<<E>>	>>A<<	19.	Valve stem seal

Fig. 60: Identifying Valve Stem Seal Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- 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 REMOVAL

CAUTION: Be careful not to drop the camshaft bearing.

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

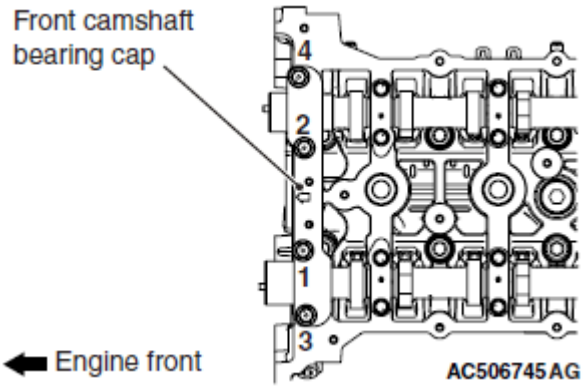


Fig. 61: Identifying Front Camshaft Bearing Cap Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

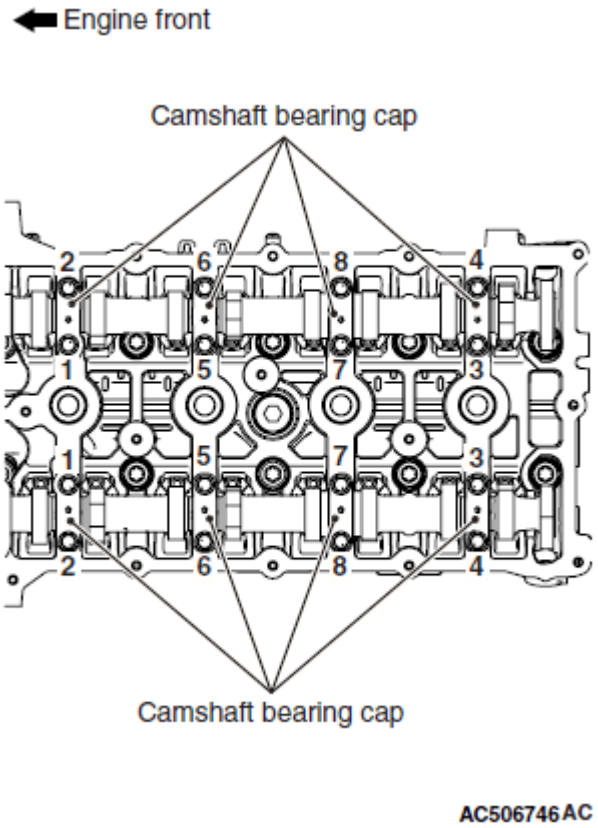


Fig. 62: Identifying Camshaft Bearing Cap Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

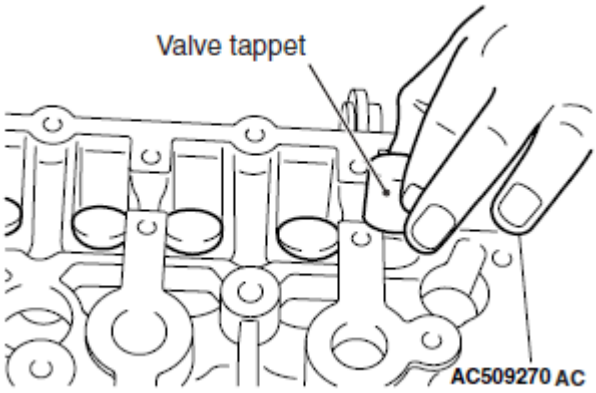


Fig. 63: Removing Valve Tappet To Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

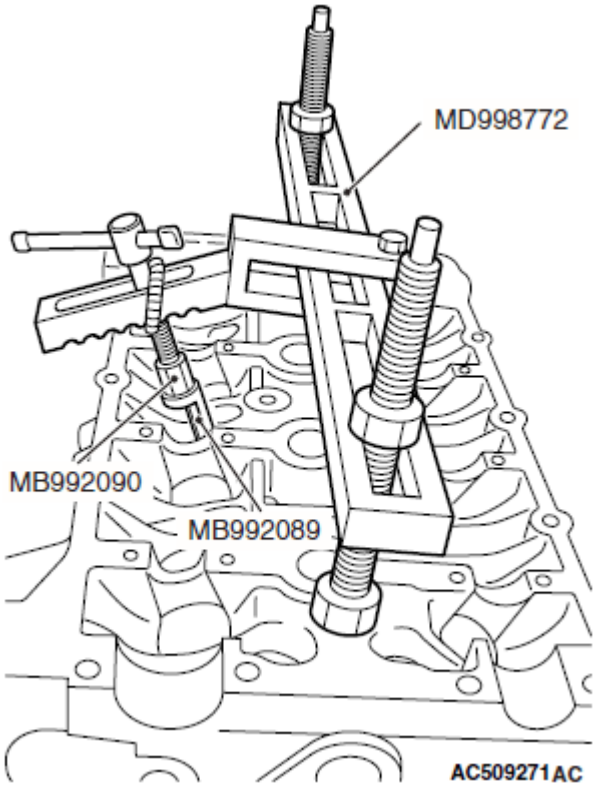


Fig. 64: Removing Valve Spring Retainer Lock Using Special Tool MB992090
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

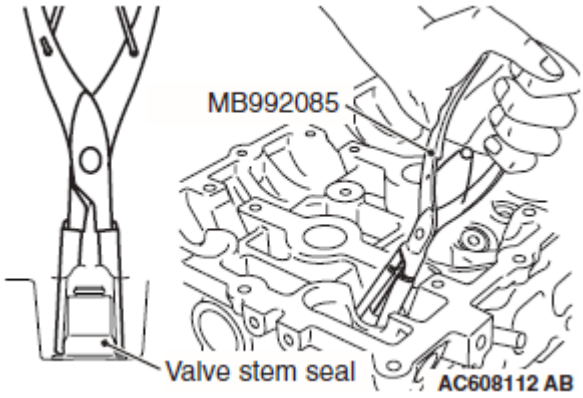


Fig. 65: Twisting Valve Stem Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< VALVE STEM SEAL INSTALLATION

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

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

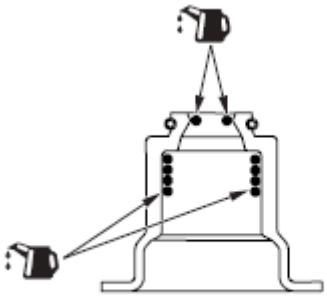


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Fig. 66: Identifying Valve Stem Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

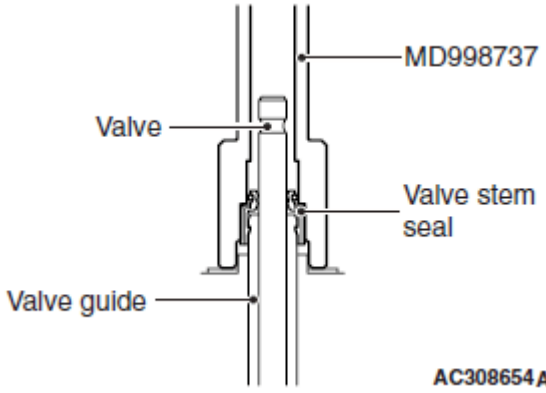


Fig. 67: Pressing Valve Stem Seal In Valve Guide
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< VALVE SPRING INSTALLATION

Install the valve spring so that the painted side faces toward the camshaft.

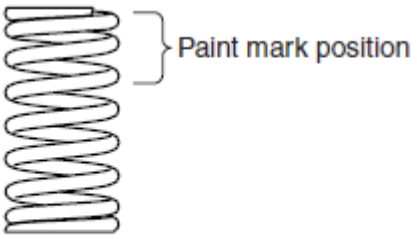


Fig. 68: Identifying Valve Spring Paint Mark Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< VALVE SPRING RETAINER LOCK INSTALLATION

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

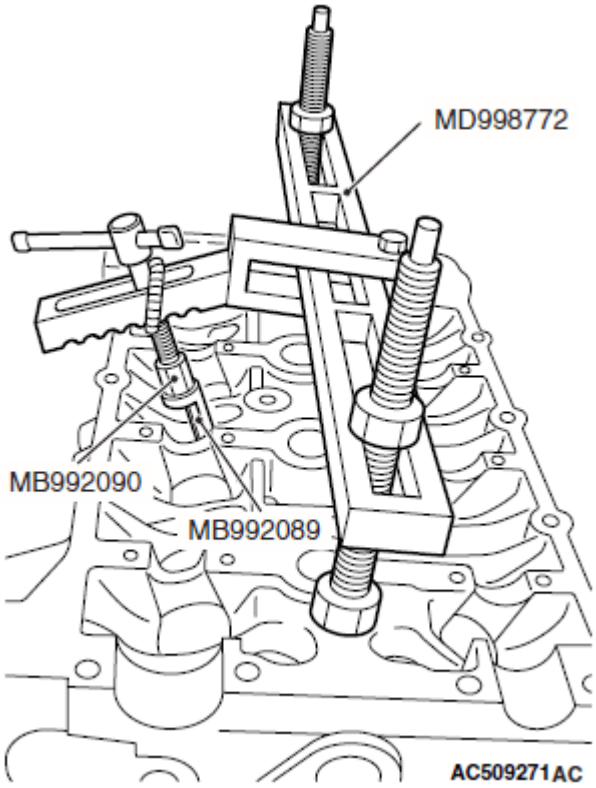


Fig. 69: Installing Valve Spring Retainer Lock Using Special Tool MB992090
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< VALVE TAPPET INSTALLATION

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

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

2. Install the valve tappet to the cylinder head.

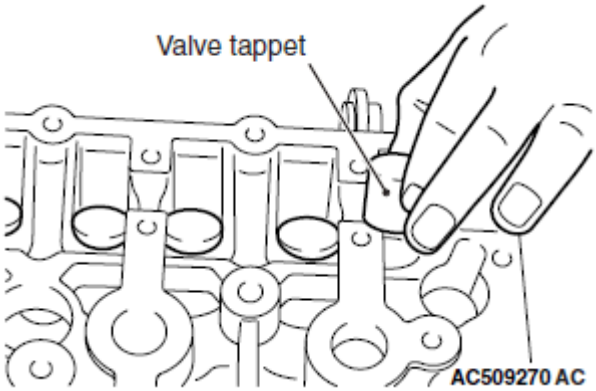


Fig. 70: Installing Valve Tappet To Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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 mounting bolts to the specified torque in the order of number shown in the illustration in two or three steps.

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

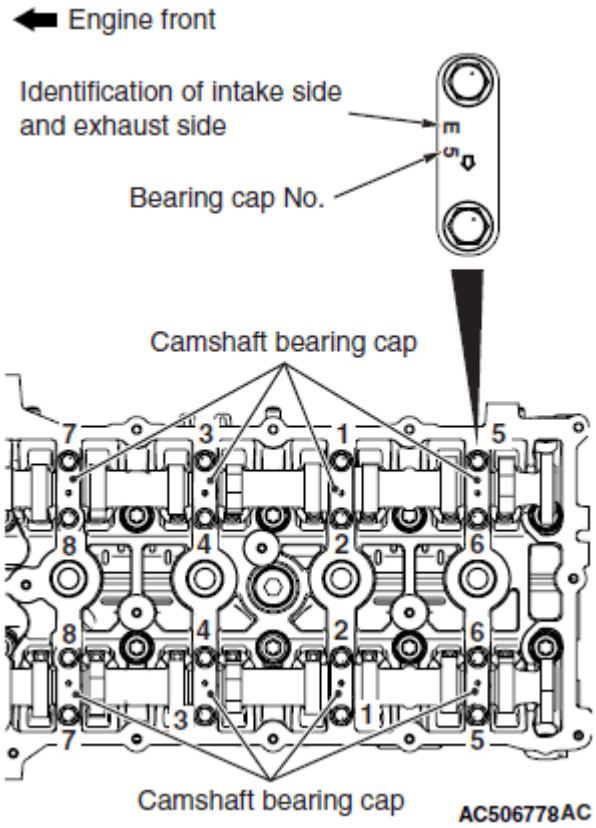


Fig. 71: Identifying Camshaft Bearing Cap Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< 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 cap 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 illustration.

FRONT CAMSHAFT BEARING CAP SPECIFICATION CHART

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

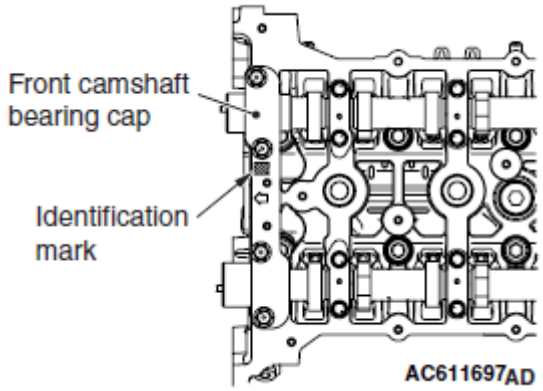


Fig. 72: Identifying Front Camshaft Bearing Cap And Identification Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

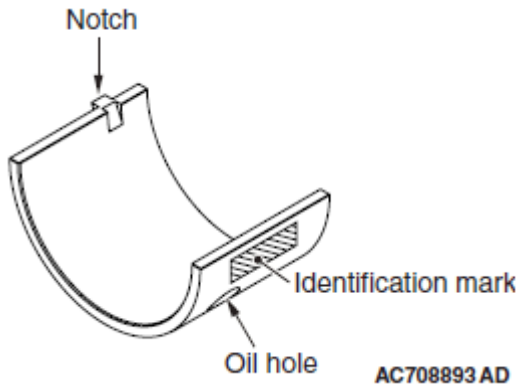


Fig. 73: Identifying Front Camshaft Bearing Identification Mark And Oil Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>G<< FRONT CAMSHAFT BEARING CAP 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 mounting bolts 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 mounting bolts again to the specified torque in the order of the figure (2.)

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

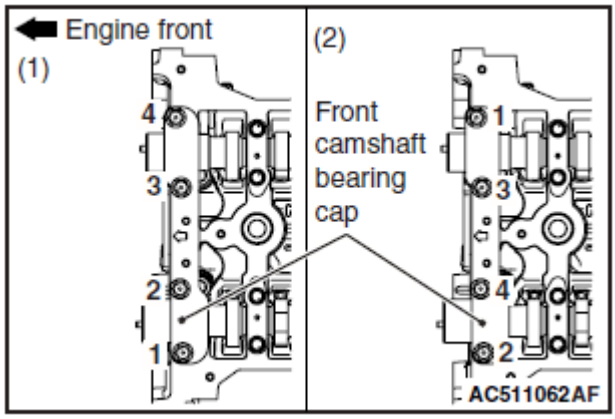
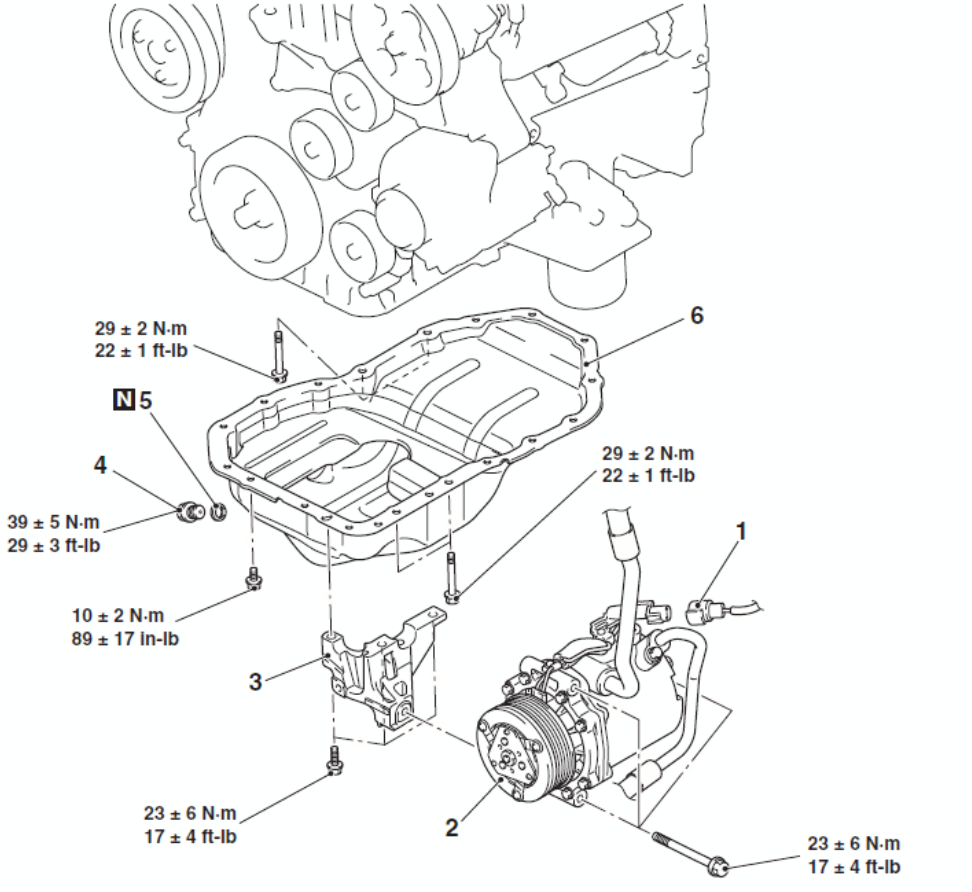


Fig. 74: Identifying Front Camshaft Bearing Cap Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front A, 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 A, B and Engine Room Side Cover (RH) Installation



		Removal steps			Removal steps (Continued)
		1. A/C compressor assembly connector connection		3.	A/C compressor bracket
<<A>>	>>C<<	2. A/C compressor and clutch assembly		4.	Engine oil pan drain plug
			>>B<<	5.	Engine oil pan drain plug gasket
			<<B>> >>A<<	6.	Engine oil pan

Fig. 75: Identifying Oil Pan Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MD998727: Oil Pan FIPG Cutter

REMOVAL SERVICE POINTS

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

1. Remove the A/C compressor and clutch assembly together with the hose from the bracket.

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

<<B>> ENGINE OIL PAN REMOVAL

1. Remove the engine oil pan mounting bolts.

CAUTION: Do not forcibly drive in special tool MD998727 to avoid damage to the engine oil pan seal surface of cylinder block assembly.

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

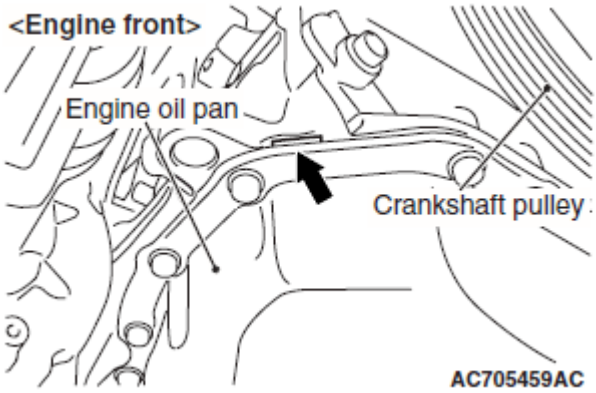


Fig. 76: Identifying Engine Oil Pan And Crankshaft Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

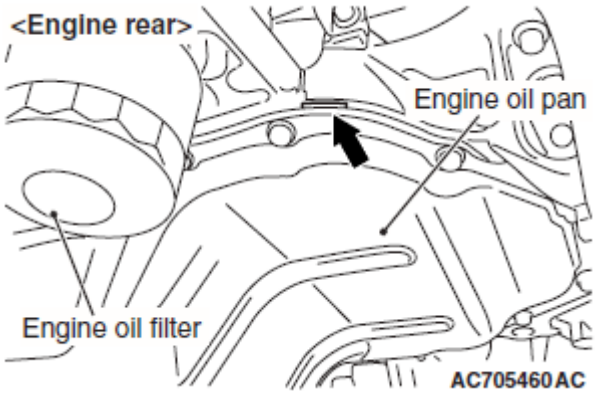


Fig. 77: Identifying Engine Oil Pan And Engine Oil Filter
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

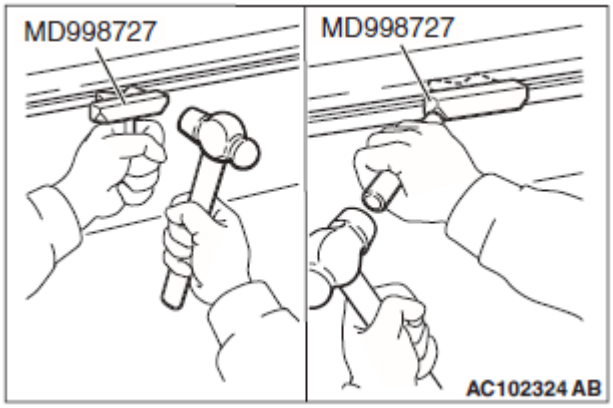


Fig. 78: Tapping Engine Oil Pan Seal Surface Using Special Tool MD998727
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.
2. Apply the sealant without any gap to the mating surface of engine oil pan as shown in the illustration, and install the engine oil pan to the cylinder block assembly.

   Specified sealant: Three bond 1217G or equivalent

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

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

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

   Tightening torque:

   M6: 10 ± 2 N.m (89 ± 17 in-lb)

   M8: 29 ± 2 N.m (22 ± 1 ft-lb)

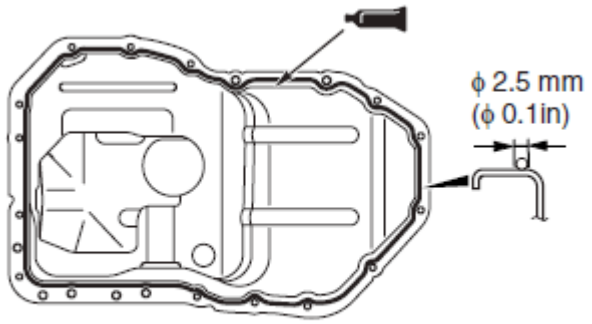


Fig. 79: Identifying Engine Oil Pan To Sealant Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

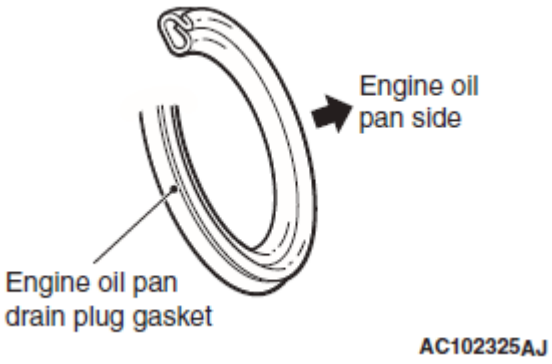


Fig. 80: Identifying Engine Oil Pan Drain Plug Gasket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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)

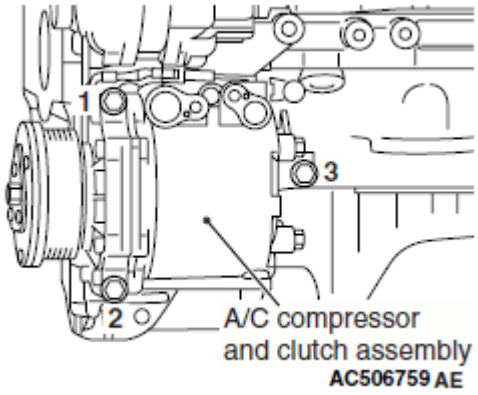


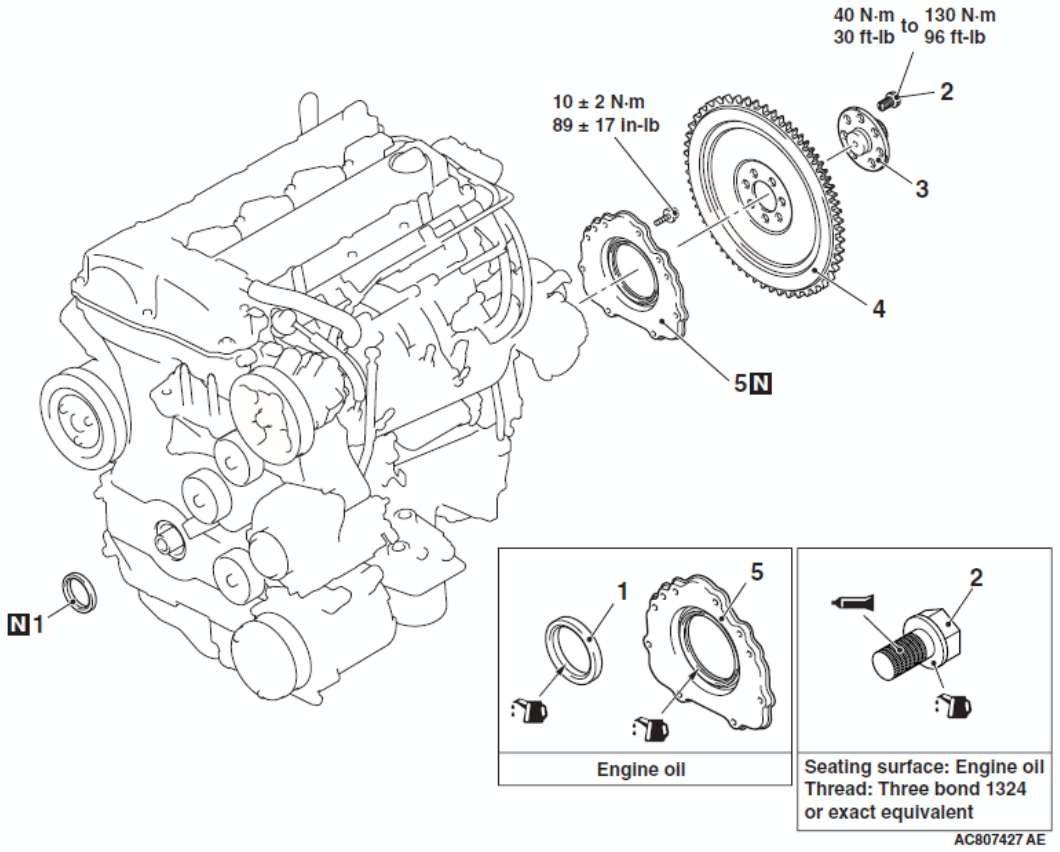
Fig. 81: Identifying A/C Compressor And Clutch Assembly Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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. Flywheel bolt
>>B<< 3. Flywheel hub
>>B<< 4. Flywheel
>>A<< 5. Crankshaft rear oil seal case assembly

Fig. 82: Identifying Crankshaft Oil Seal Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991883: Flywheel Stopper
- MB991448: Bush Remover And Installer Base

REMOVAL SERVICE POINT

<<A>> FLYWHEEL BOLT REMOVAL

Fix the flywheel using special tool MB991883, and loosen the flywheel bolts.

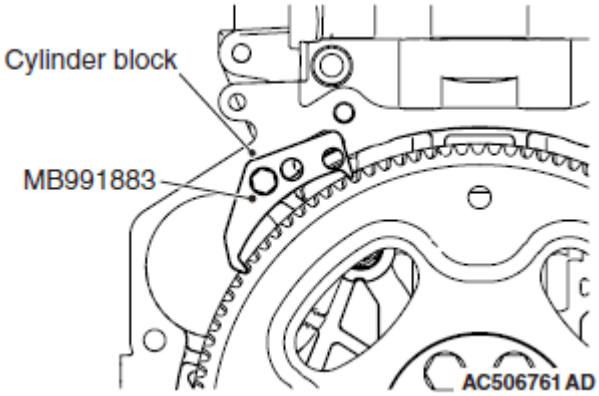


Fig. 83: Fixing Flywheel Assembly Using Special Tool MB991883
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< CRANKSHAFT REAR OIL SEAL CASE ASSEMBLY INSTALLATION

1. Remove all the traces of sealant adhering to the cylinder block and ladder frame using a remover or others. Then, degrease them using.
2. Apply the sealant without any gap to the cylinder block and ladder frame as shown in the illustration, and install the crankshaft rear oil seal case assembly.

   Specified sealant: Three bond 1227D or equivalent

   NOTE: Install the crankshaft rear oil seal case assembly immediately after applying sealant.

3. Apply a small amount of engine oil to the entire inner diameter of the crankshaft rear oil seal lip, and install the crankshaft rear oil seal case assembly.

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

4. Tighten the crankshaft rear oil seal case assembly mounting bolts to the specified torque.

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

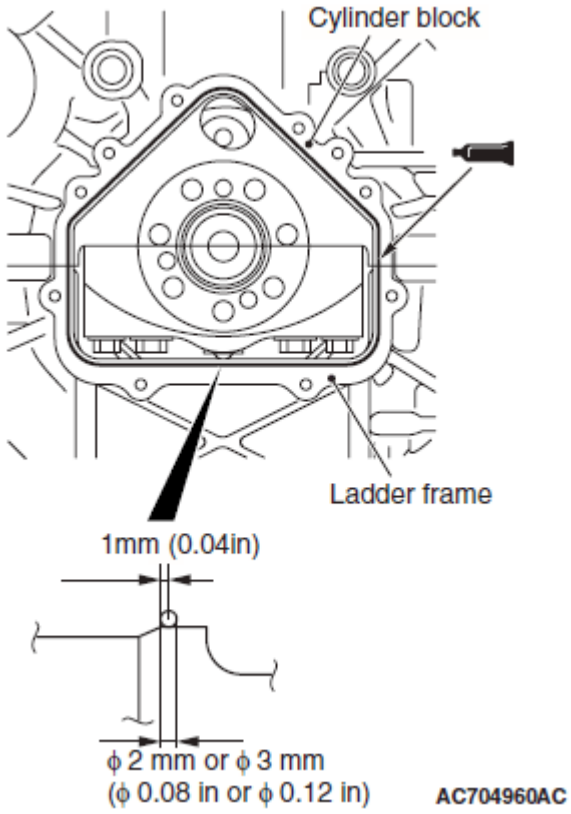


Fig. 84: Identifying Crankshaft Rear Oil Seal Case Assembly To Sealant Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< FLYWHEEL/FLYWHEEL HUB/FLYWHEEL BOLT INSTALLATION

1. Remove the sealant, the engine oil, and other adhering materials from the flywheel bolt threads, crankshaft tapped hole, and flywheel.
2. Install the flywheel and flywheel hub to the crankshaft.
3. Use special tool MB991883 to secure the flywheel 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 flywheel bolts.

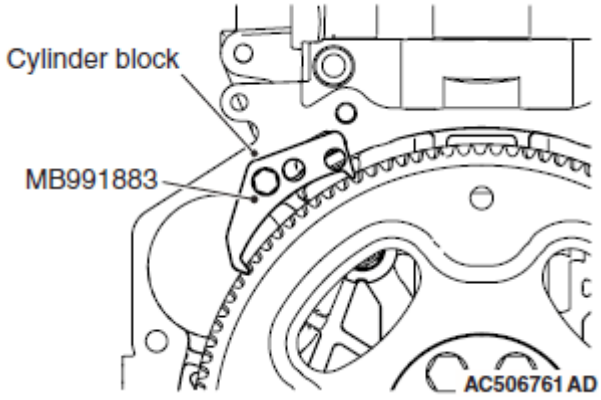


Fig. 85: Fixing Flywheel Assembly Using Special Tool MB991883
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Apply sealant to the thread of the flywheel bolts.

   Specified sealant: Three bond 1324 or exact equivalent

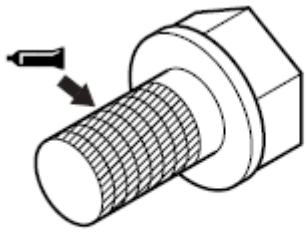


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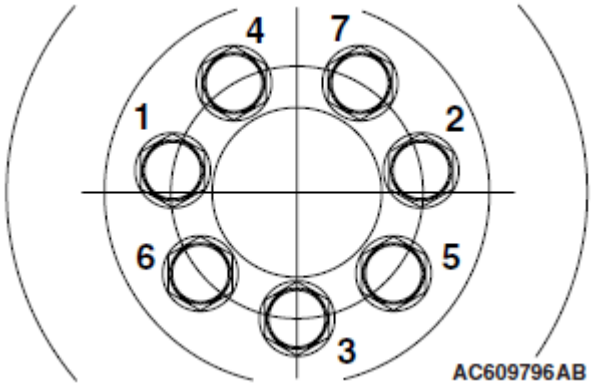
Fig. 86: Identifying Sealant Applying Area To Flywheel Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Tighten the flywheel bolts to temporary torque in the order shown in the illustration.

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

7. Tighten the flywheel bolts to specified torque in the order shown in the illustration.

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



AC609796AB

Fig. 87: Identifying Flywheel Bolts Tightening 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 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.

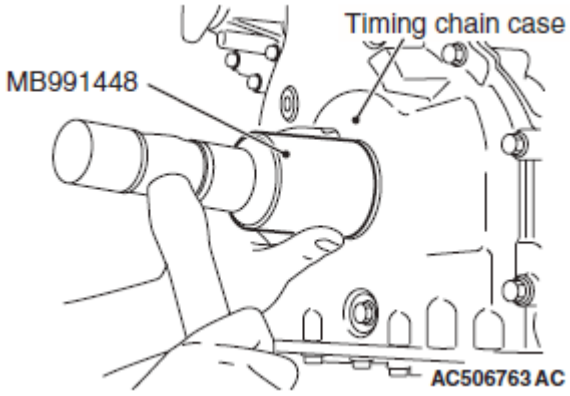
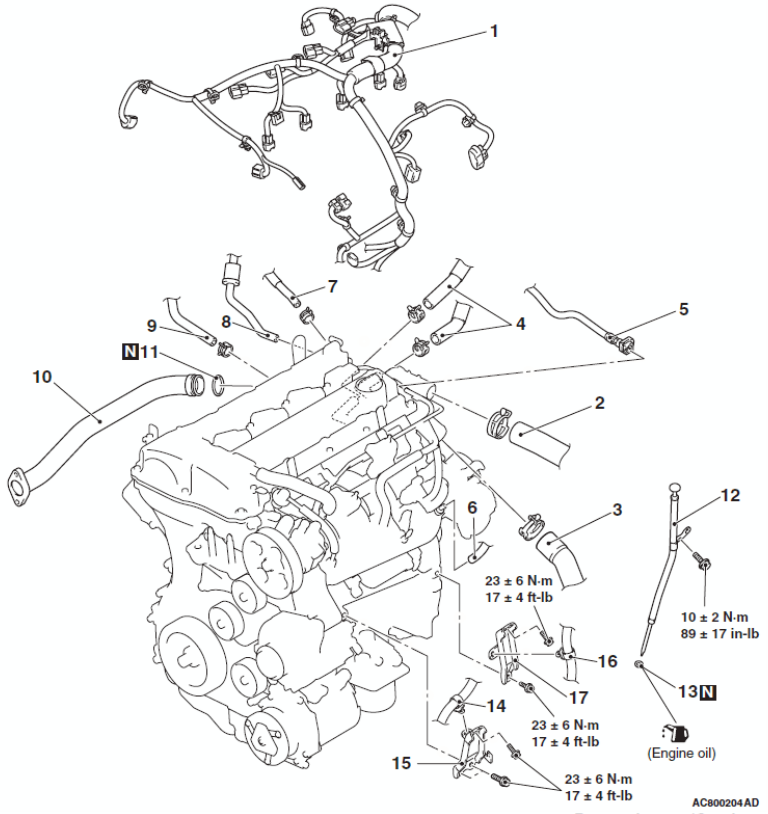


Fig. 88: Pressing Crankshaft Front Oil Seal Using Special Tool MB991448
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal Operation	Post-installation Operation
• Fuel Line Pressure Reduction	• Water Pump Installation
• Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal	• Throttle Body Assembly Installation
• Engine Coolant Draining	• Exhaust Manifold and Turbocharger Assembly Installation
• Air Cleaner Assembly Removal	• Strut Tower Bar Installation
• Charge Air Cooler Intake Hose A Removal	• Ignition Coil Installation
• Ignition Coil Removal	• Charge Air Cooler Intake Hose A Installation
• Strut Tower Bar Removal	• Air Cleaner Assembly Installation
• Exhaust Manifold and Turbocharger Assembly Removal	• Engine Coolant Refilling
• Throttle Body Assembly Removal	• Fuel Leak Check • Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation
• Water Pump Removal	



Removal steps

1. Control wiring harness connection

<<A>> >>H<< 2. Radiator upper hose connection

<<A>> >>H<< 3. Radiator lower hose connection

4. Heater hose connection

<<B>> >>G<< 5. Fuel high-pressure hose connection

6. Turbocharger by-pass valve purge hose connection
7. Fuel return hose connection
8. Emission vacuum hose connection

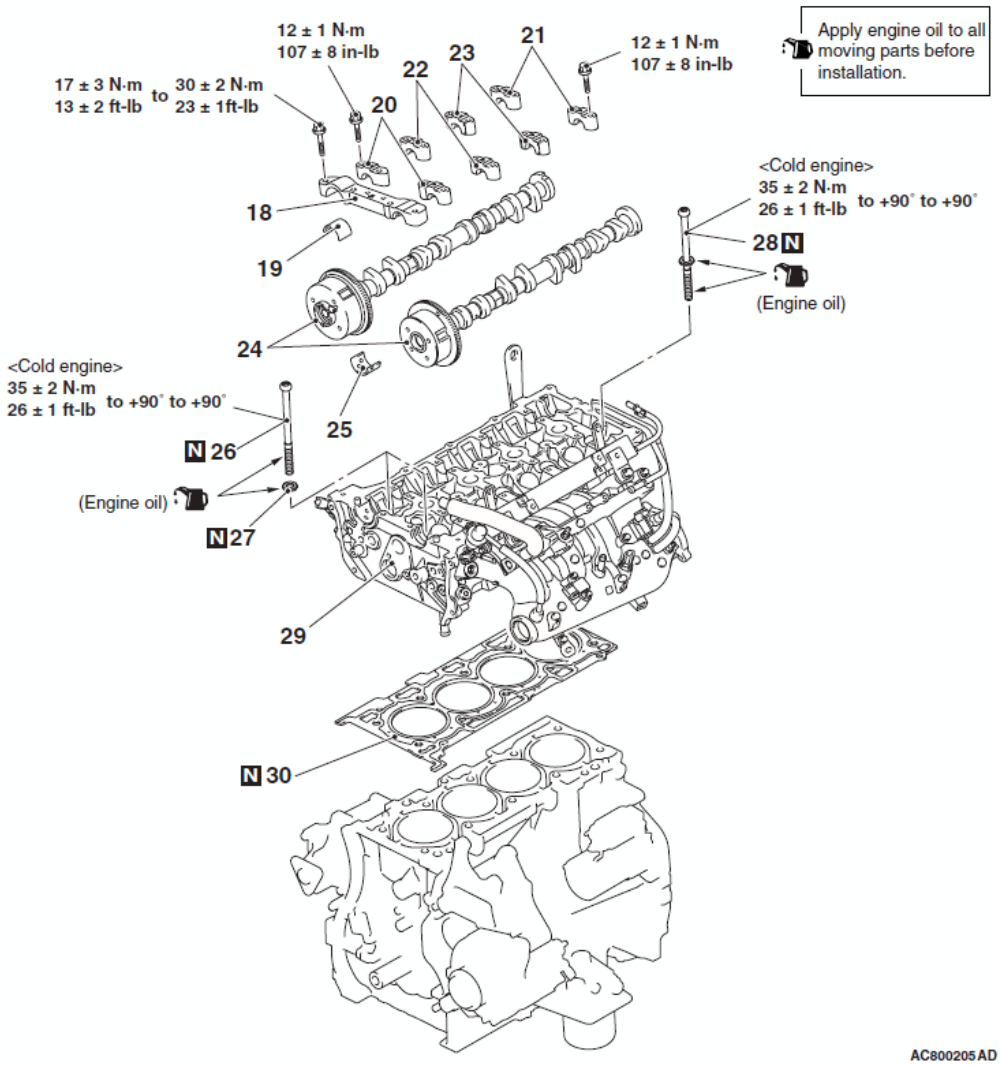
Removal steps (Continued)

9. Brake booster vacuum hose connection
10. Water pump intake pipe

>>F<< 11. O-ring

12. Engine oil level gauge and guide assembly
13. O-ring
14. Starter wiring harness clamp connection
15. Intake manifold stay (front)
16. Starter wiring harness clamp connection
17. Intake manifold stay (rear)

Fig. 89: Identifying Cylinder Head Gasket Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



			Removal steps
		•	Timing chain
<<C>>	>>E<<	18.	Front camshaft bearing cap
	>>C<<	19.	Camshaft bearing
<<D>>	>>D<<	20.	Oil feeding camshaft bearing cap
<<D>>	>>D<<	21.	Camshaft bearing cap
<<D>>	>>D<<	22.	Camshaft bearing cap
<<D>>	>>D<<	23.	Thrust camshaft bearing cap

			Removal steps (Continued)
>>C<<		24.	Camshaft and camshaft sprocket assembly
>>C<<		25.	Camshaft bearing
<<E>>	>>B<<	26.	Cylinder head bolt
<<E>>	>>B<<	27.	Cylinder head bolt washer
<<E>>	>>B<<	28.	Cylinder head bolt and washer assembly
>>A<<		29.	Cylinder head assembly
>>A<<		30.	Cylinder head gasket

Fig. 90: Identifying Cylinder Head Gasket Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

REMOVAL SERVICE POINTS

<<A>> RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

Make mating marks on the radiator hose and the hose clamp as shown to install them in the original position. Then, remove them.

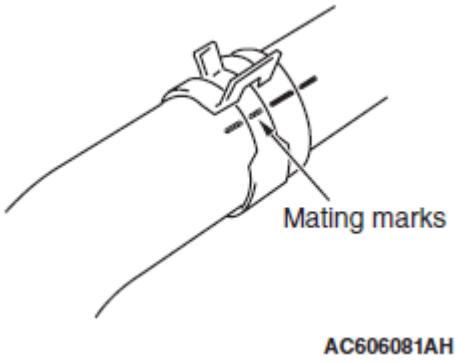


Fig. 91: Identifying Mating Marks On Radiator Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> FUEL HIGH-PRESSURE HOSE DISCONNECTION

1. Follow the steps below to unlock the fuel high-pressure hose connector.

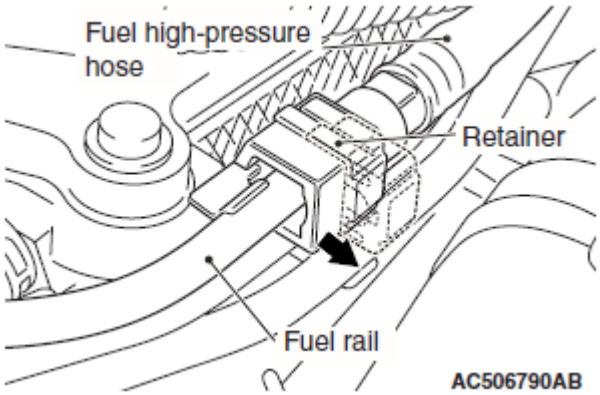


Fig. 92: Disconnecting Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

1. Insert a flat-tipped screwdriver [6 mm (0.24 inch) wide and 1 mm (0.04 inch) thick] into the retainer of the fuel high-pressure hose connector.

CAUTION: When pushing up the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.

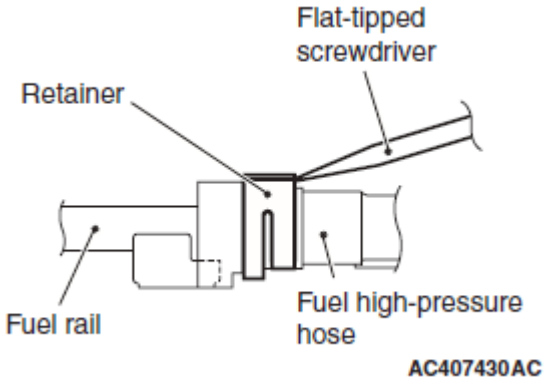


Fig. 93: Inserting Flat-Tipped Screwdriver Into Retainer Of Fuel High-Pressure Hose Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Turn the flat-tipped screwdriver inserted into the retainer by 90 degrees angle to push up the retainer and unlock the fuel high-pressure hose connector.

2. Disconnect the fuel high-pressure hose.

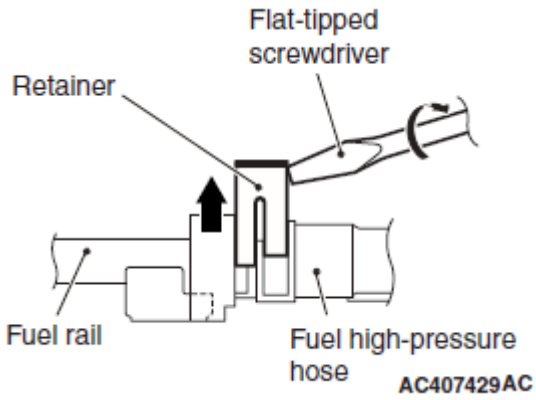


Fig. 94: Disconnecting Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<C>> FRONT CAMSHAFT BEARING CAP REMOVAL

1. Temporarily install the engine oil pan which was removed at the 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 MB991454, MB991928 or MB991895 which was installed for supporting the engine and transaxle assembly when the timing chain was removed.

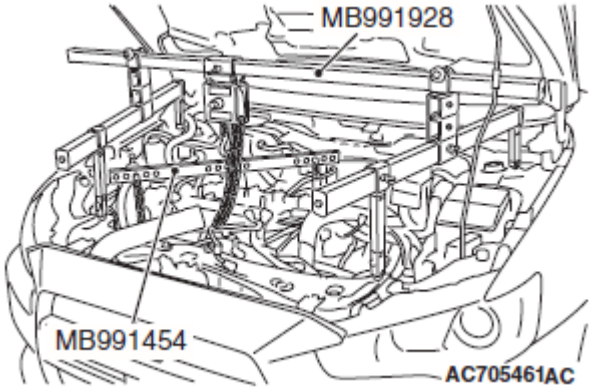


Fig. 95: Supporting Engine And Transaxle Assembly Using Special Tool MB991454, MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

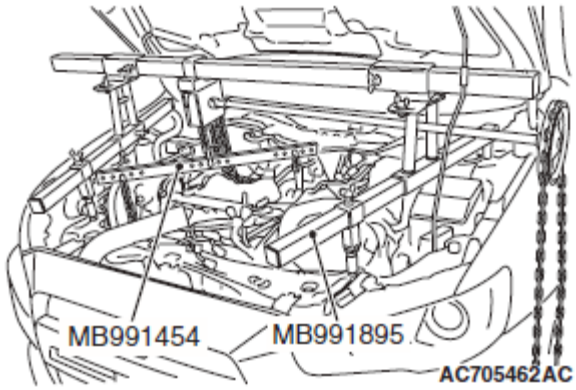


Fig. 96: Supporting Engine And Transaxle Assembly Using Special Tool MB991454, MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Be careful not to drop the camshaft bearing.

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

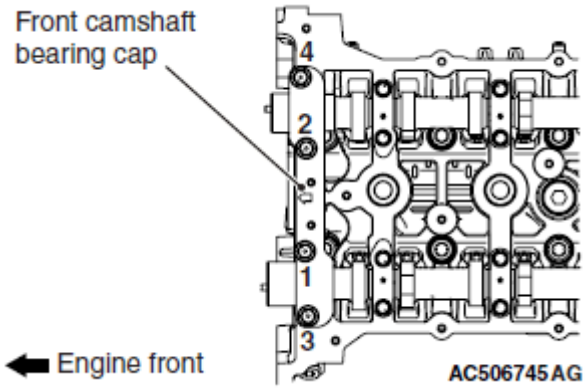


Fig. 97: Identifying Front Camshaft Bearing Cap Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

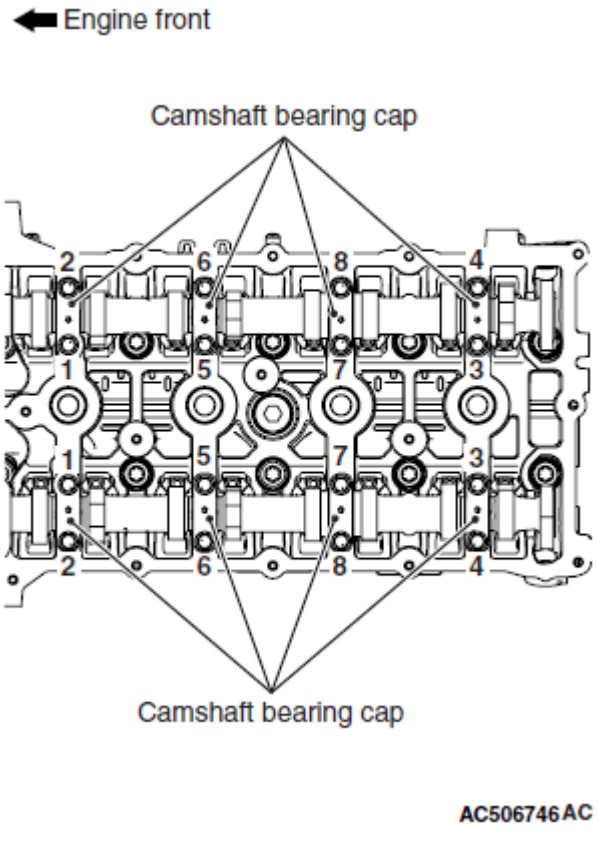


Fig. 98: Identifying Camshaft Bearing Cap Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<E>> CYLINDER HEAD BOLT/CYLINDER HEAD BOLT WASHER/CYLINDER HEAD BOLT AND WASHER ASSEMBLY REMOVAL

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

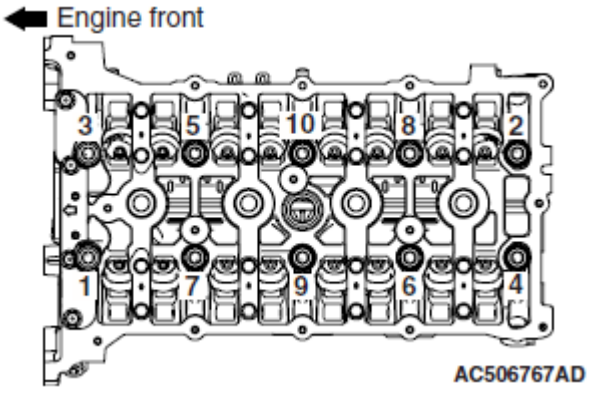


Fig. 99: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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, degrease the sealant application surface.

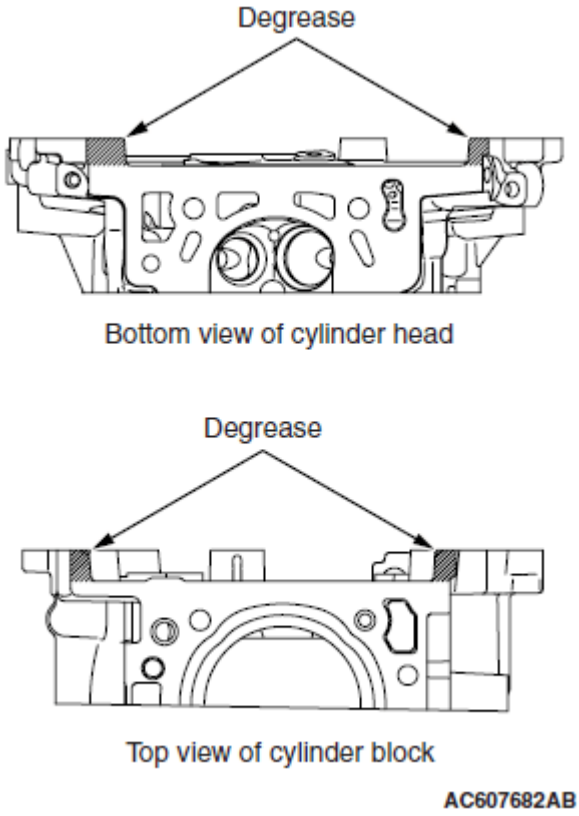


Fig. 100: Identifying Top Surface Of Cylinder Block And Bottom Surface Of Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   Specified sealant: Three bond 1217G or equivalent

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 illustration.

Specified sealant: Three bond 1217G or equivalent

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

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

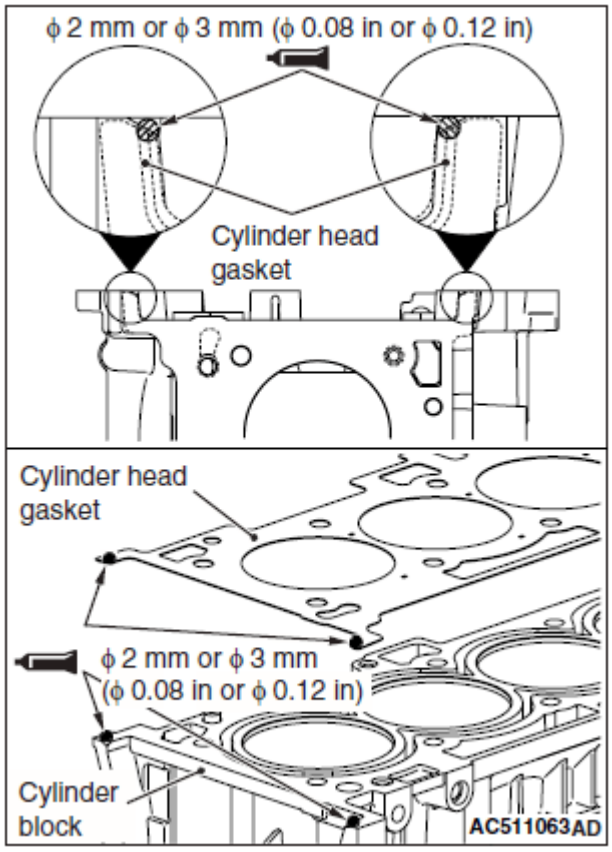


Fig. 101: Applying Sealant To Top Surface Of Cylinder Head Gasket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

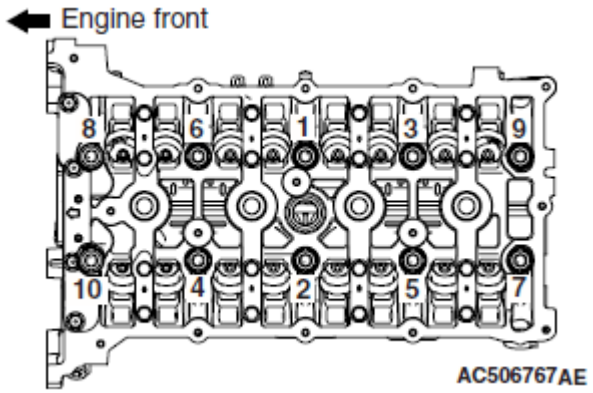


Fig. 102: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

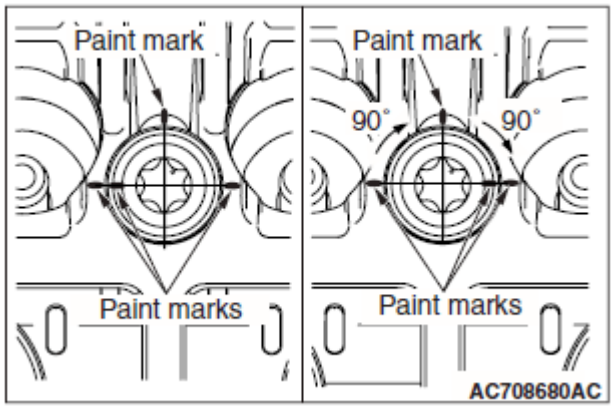


Fig. 103: Identifying Paint Mark On Cylinder Head
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 illustration.

FRONT CAMSHAFT BEARING CAP SPECIFICATION CHART

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

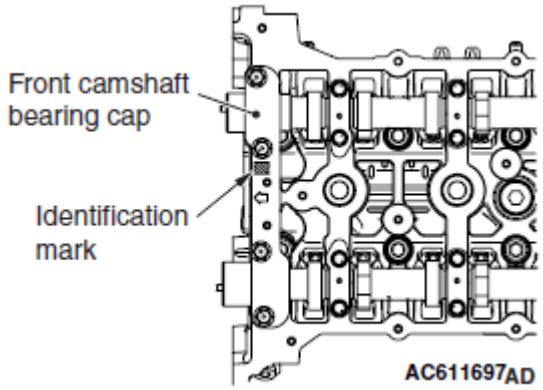


Fig. 104: Identifying Front Camshaft Bearing Cap And Identification Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

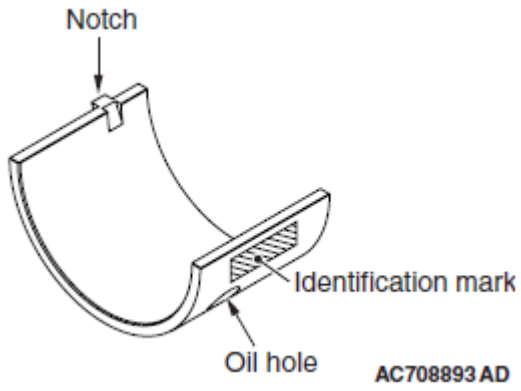


Fig. 105: Identifying Front Camshaft Bearing Identification Mark And Oil Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 bolts to the specified torque in the order of number shown in the illustration in two or three steps.

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

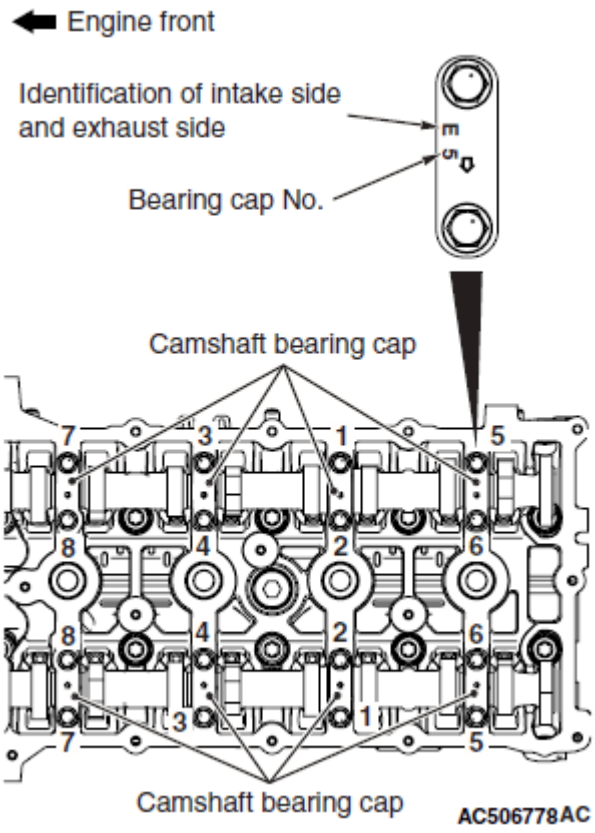


Fig. 106: Identifying Camshaft Bearing Cap Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< FRONT CAMSHAFT BEARING CAP 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 mounting bolts 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 mounting bolts again to the specified torque in the order of the figure (2.)

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

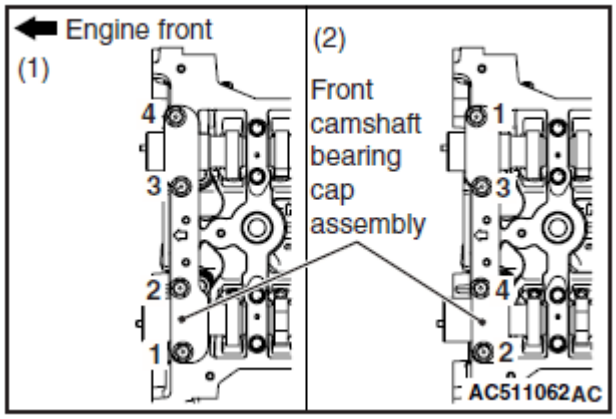


Fig. 107: Identifying Front Camshaft Bearing Cap Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

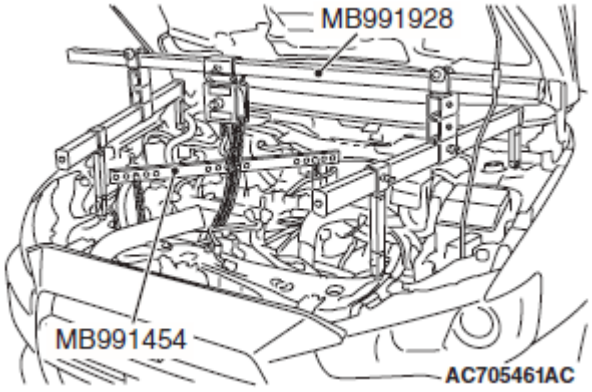


Fig. 108: Supporting Engine And Transaxle Assembly Using Special Tool MB991454, MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

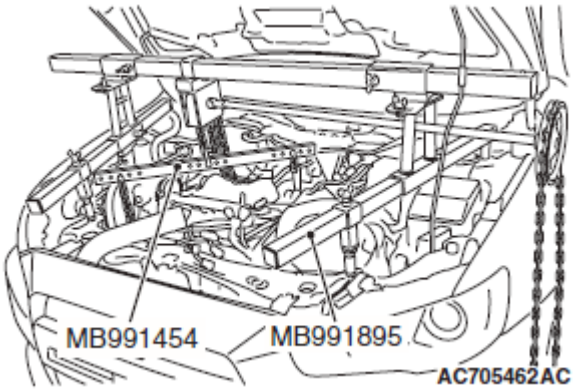


Fig. 109: Supporting Engine And Transaxle Assembly Using Special Tool MB991454, MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< O-RING INSTALLATION

CAUTION: Avoid adhesion of engine oil or grease to the O-ring.

Fit the O-ring in the water pump inlet pipe groove, wet the O-ring circumference or the pipe mounting area inner wall, and then insert the O-ring.

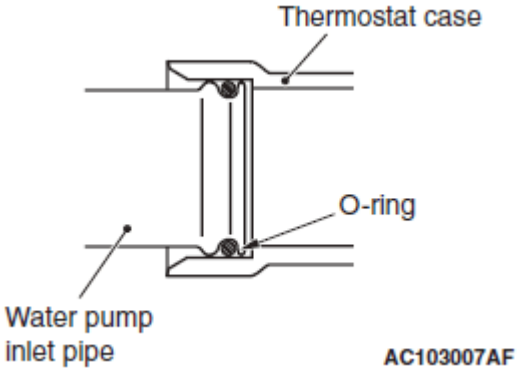


Fig. 110: Identifying O-Ring And Water Pump Inlet Pipe
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>G<< FUEL HIGH-PRESSURE HOSE CONNECTION

CAUTION:
- **When pushing in the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.**
- **After the installation of the fuel high-pressure hose, slightly pull the fuel high-pressure hose to check that it is connected securely. At this time, also check that there is approximately 1 mm (0.04 inch) play.**

1. Securely insert the fuel rail stopper into the fuel high-pressure hose connector groove to install the fuel

high-pressure hose to the fuel rail.

2. Push in the retainer of the fuel high-pressure hose connector to lock the fuel high-pressure hose and fuel rail.

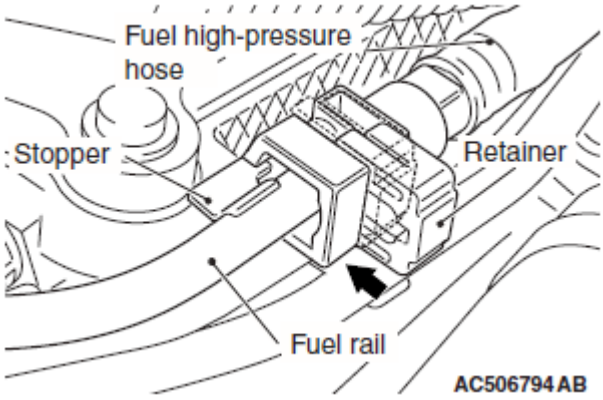


Fig. 111: Identifying Fuel High-Pressure Hose To Fuel Rail
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>H<< RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

1. Insert radiator hose as far as the projection of the water inlet fitting or water outlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

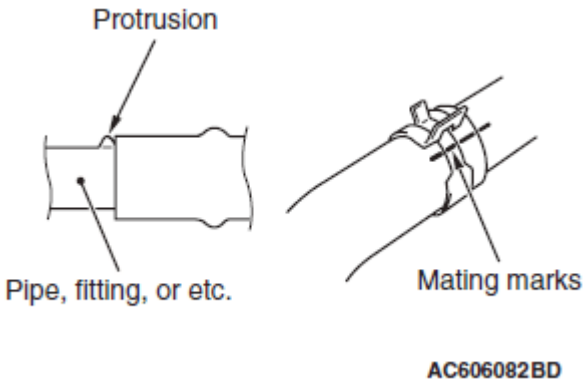
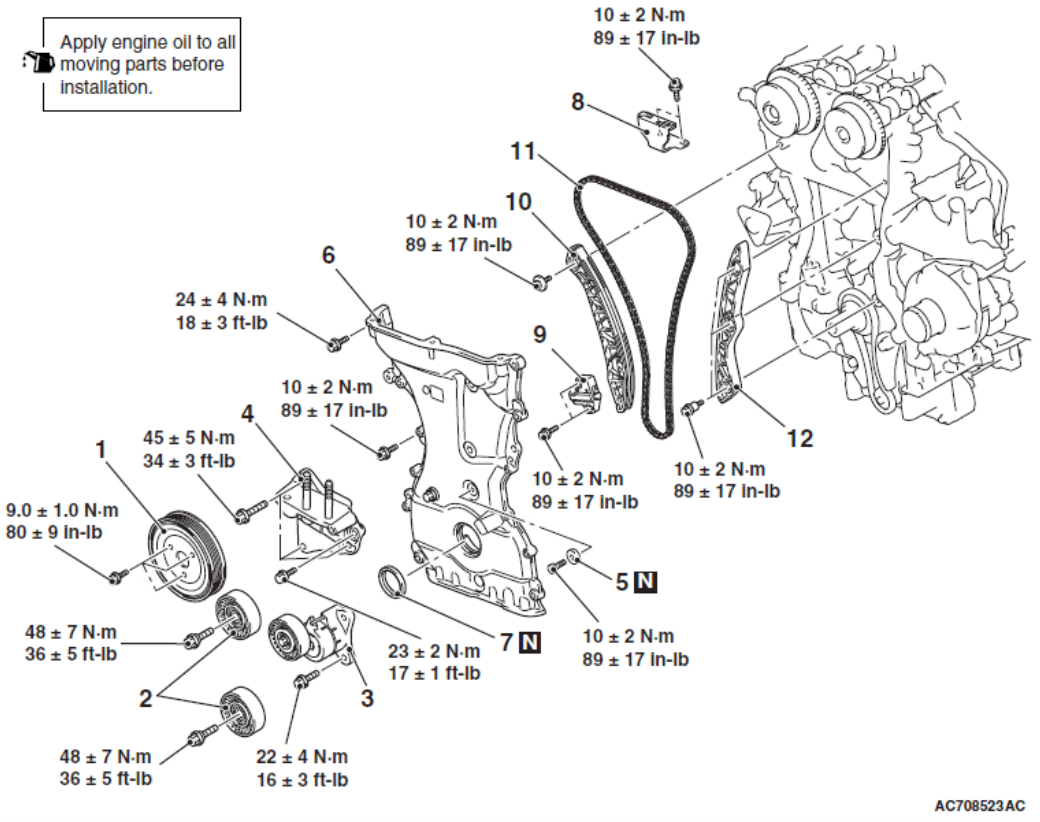


Fig. 112: Identifying Mating Marks On Radiator Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING CHAIN

REMOVAL AND INSTALLATION

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Removal (Refer to GROUP 51, Under Cover P.51-17.) • Engine Oil Draining (Refer to GROUP 12, On-vehicle Service –Engine Oil Replacement P.12-5.) • Strut Tower Bar Removal (Refer to GROUP 42A, Strut Tower Bar P.42A-16.) • Rocker Cover Assembly Removal (Refer to P.11C-26.) • Engine Oil Pan Removal (Refer to P.11C-52.)	• Engine Oil Pan Installation (Refer to P.11C-52.) • Rocker Cover Assembly Installation (Refer to P.11C-26.) • Strut Tower Bar Installation (Refer to GROUP 42A, Strut Tower Bar P.42A-16.) • Engine Oil Refilling (Refer to GROUP 12, On-vehicle Service –Engine Oil Replacement P.12-5.) • Engine Room Under Cover Front A, B and Engine Room Side Cover (RH) Installation (Refer to GROUP 51, Under Cover P.51-17.)



Removal steps

<<A>>
- Power steering oil pump assembly (Refer to GROUP 37, Power Steering Oil Pump P.37-49)
- Headlight support panel cover (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-3)

<<B>>
- Engine and transaxle assembly holding

Removal steps (Continued)

- Engine mounting bracket (Refer to GROUP 32, Engine Mounting P.32-6)

<<C>>
- Crankshaft pulley (Refer to P.11C-21)

>>E<<
1. Water pump pulley
2. Idler pulley

<<D>>
3. Auto-tensioner
4. Cylinder block engine front mounting bracket
5. Gasket

<<E>> >>D<<
6. Timing chain case assembly

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

<<F>> >>B<<
9. Timing chain tensioner
10. Timing chain tension side guide

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

Fig. 113: Identifying Timing Chain Components With Torque Specification
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

REMOVAL SERVICE POINTS

<<A>> 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 timing chain.

<<B>> ENGINE AND TRANSAXLE ASSEMBLY HOLDING

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

1. <Special tool MB991928 is used>
    1. Assemble the special tool MB991928. Set the following parts on the base hanger.
        - Slide bracket (HI)
        - Foot x 4 (standard) (MB991932)
        - Joint x 2 (90) (MB991930)
    2. Set the foot of the special tool as shown in the illustration.

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

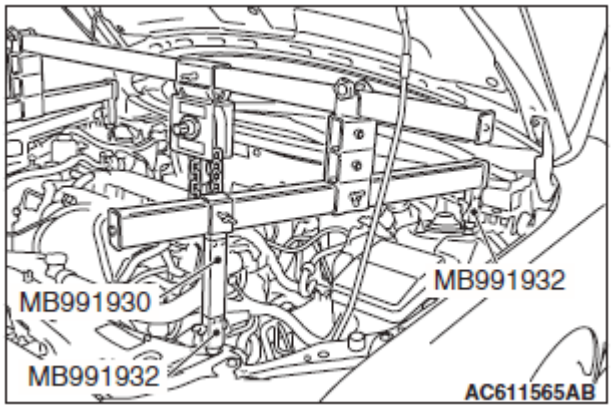


Fig. 114: Holding Engine And Transaxle Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Mount special tool MB991454 to the power steering oil pump bracket and engine hanger, and set it to special tool MB991928 to support the engine and transaxle assembly.

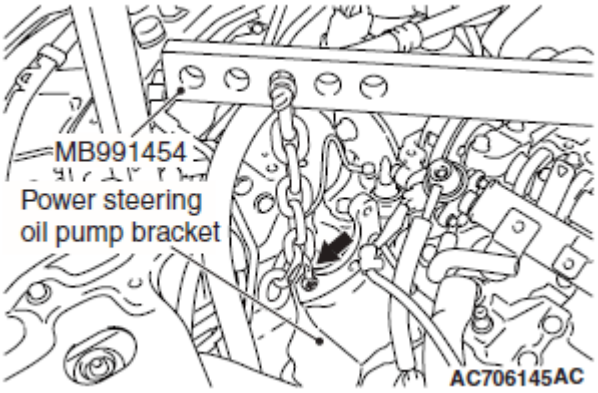


Fig. 115: Identifying Power Steering Oil Pump Bracket And Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

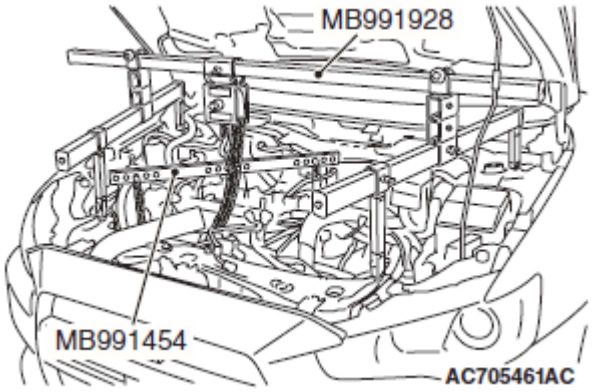


Fig. 116: Supporting Engine And Transaxle Assembly Using Special Tool MB991454, MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. <Special tool MB991895 is used>
    1. Set the foot of special tool MB991895 as shown in the illustration.

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

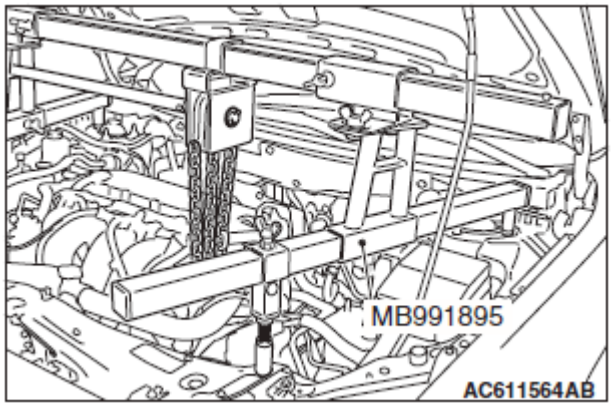


Fig. 117: Setting Foot Of Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Mount special tool MB991454 to the power steering oil pump bracket and engine hanger, and set it to special tool MB991895 to support the engine and transaxle assembly.

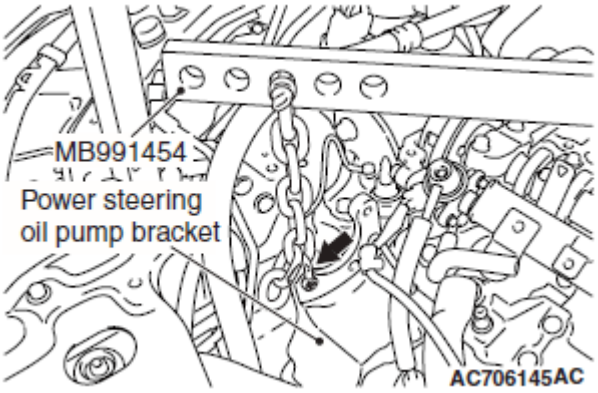


Fig. 118: Identifying Power Steering Oil Pump Bracket To Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

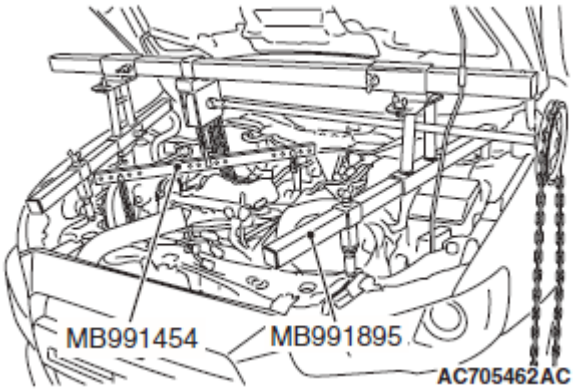


Fig. 119: Supporting Engine And Transaxle Assembly Using Special Tool MB991454, MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<C>> CRANKSHAFT PULLEY REMOVAL

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

<<D>> AUTO-TENSIONER REMOVAL

Loosen the mounting bolt of generator assembly lower part, and remove the mounting bolt of generator assembly upper part. Slide the generator assembly, and remove the auto-tensioner.

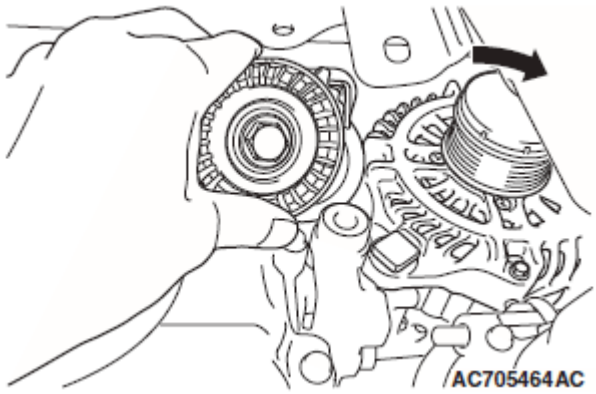


Fig. 120: Removing Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<E>> TIMING CHAIN CASE ASSEMBLY REMOVAL

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

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

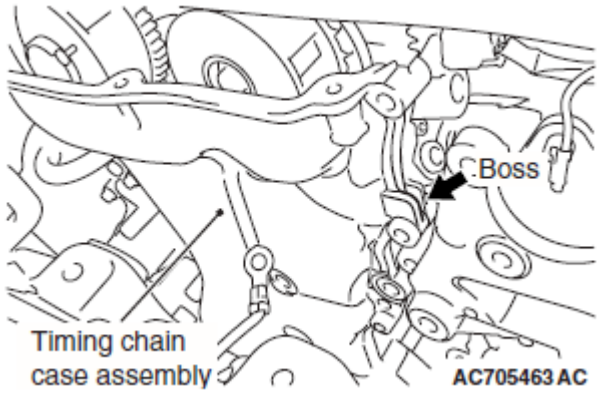


Fig. 121: Locating Boss Of Timing Chain Case Assembly

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

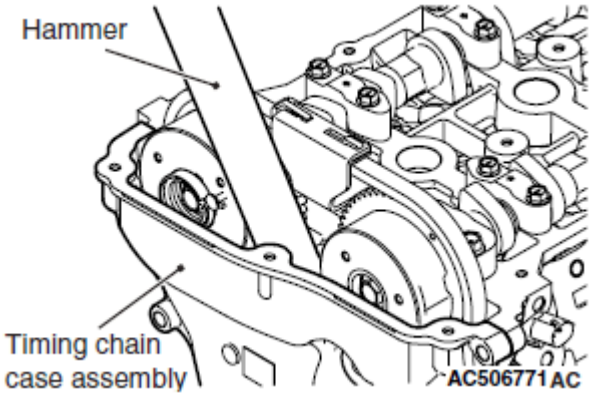


Fig. 122: Identifying Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<F>> TIMING CHAIN TENSIONER REMOVAL

1. Temporarily install the crankshaft pulley to the crankshaft.

CAUTION: Never turn the crankshaft counterclockwise.

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

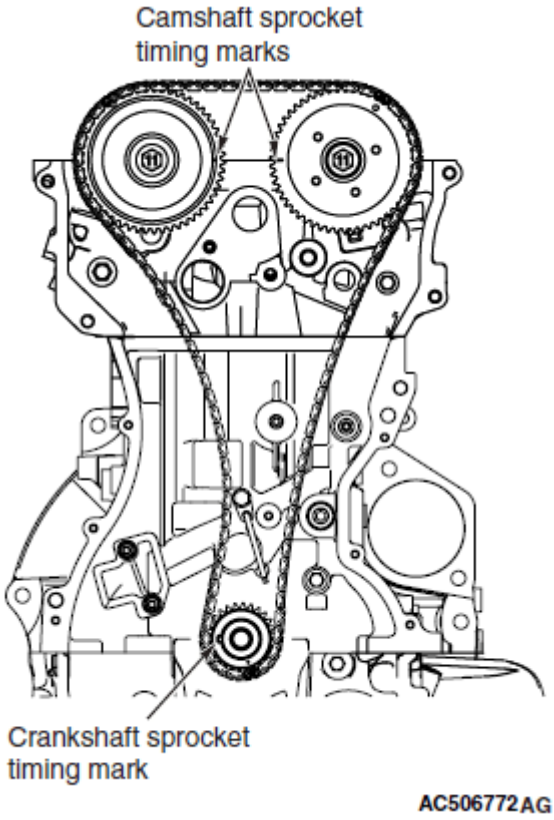


Fig. 123: Identifying Camshaft Sprocket Timing Marks And Crankshaft Sprocket Timing Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

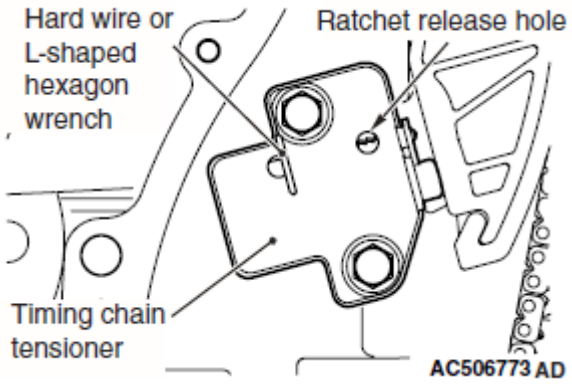


Fig. 124: Identifying Timing Chain Tensioner And Hard Wire Or L-Shaped Hexagon Wrench
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< TIMING CHAIN INSTALLATION

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

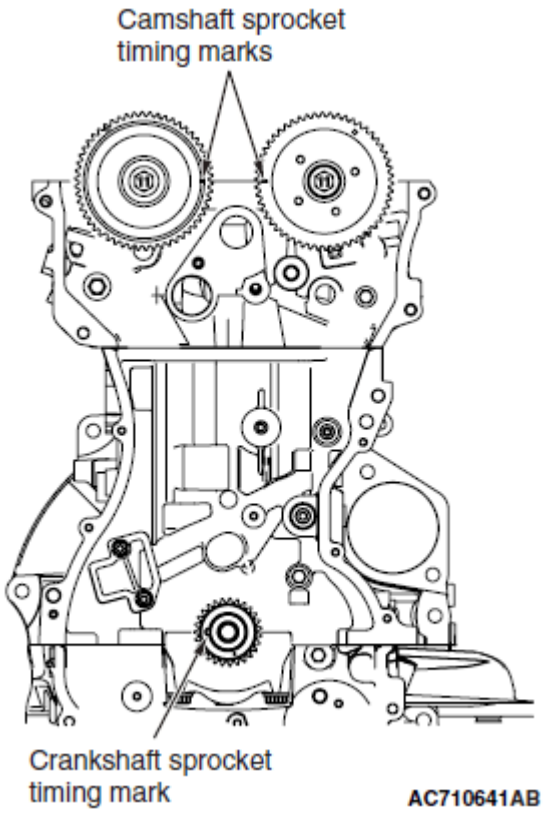


Fig. 125: Identifying Camshaft Sprockets Timing Marks And Crankshaft Sprocket Timing Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Align each sprocket timing chain mating marks 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.

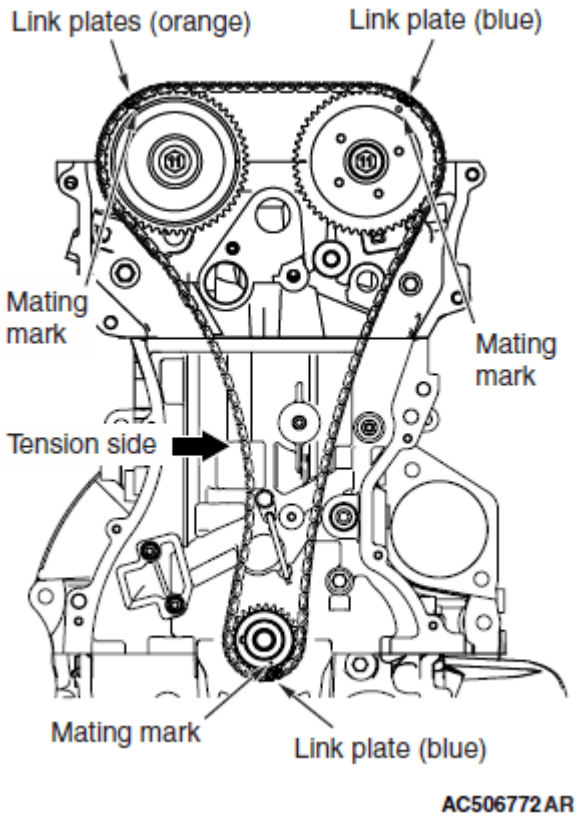


Fig. 126: Identifying Sprocket Timing Chain Mating Marks With Link Plate
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

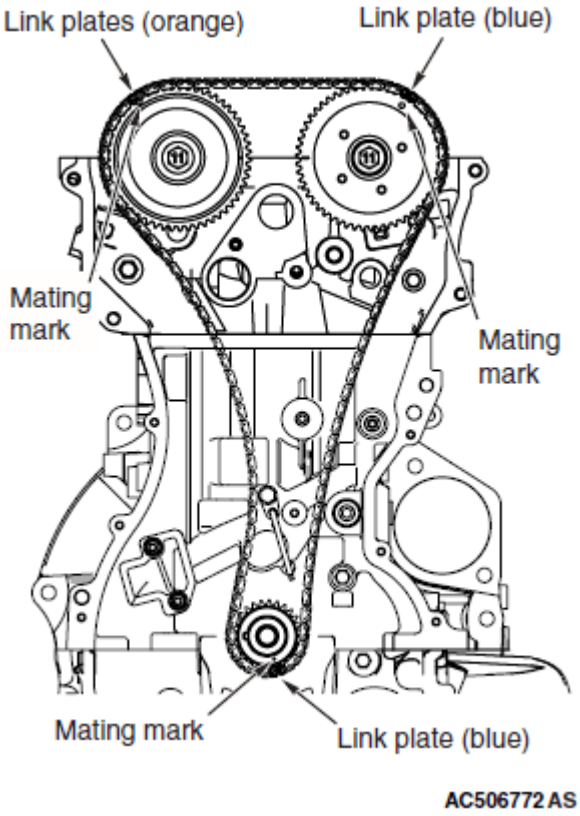


Fig. 127: Identifying Sprocket Timing Chain Mating Marks With Link Plates
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

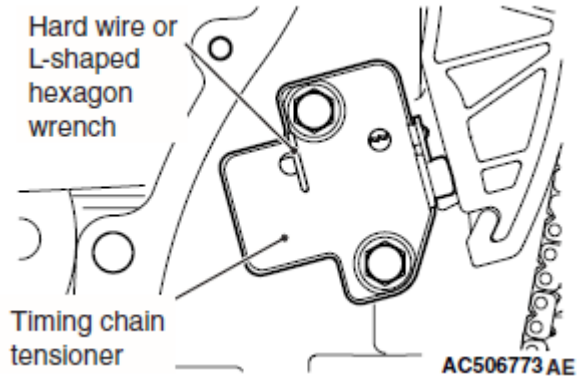


Fig. 128: Identifying Timing Chain Tensioner And Hard Wire Or L-Shaped Hexagon Wrench
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

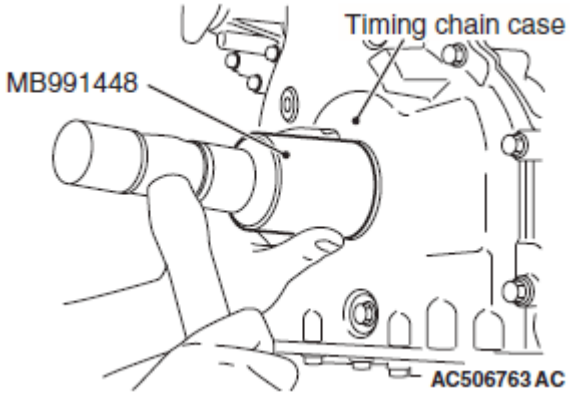


Fig. 129: Pressing Crankshaft Front Oil Seal Using Special Tool MB991448
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< TIMING CHAIN CASE ASSEMBLY INSTALLATION

CAUTION:
- **Be sure to remove the sealant remaining in the mounting hole, O-ring groove, and gap between parts.**
- **After degreasing, check that there is no oil on the surface where the sealant is applied.**
- **After degreasing, 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.
2. Remove all the sealant adhering to the gasket between the cylinder head and cylinder block (three-surface aligned part.) Then, degrease the surfaces.
3. As for the three-surface aligned part that is indicated in Step 2 above, 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 illustration, 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.**

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

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

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

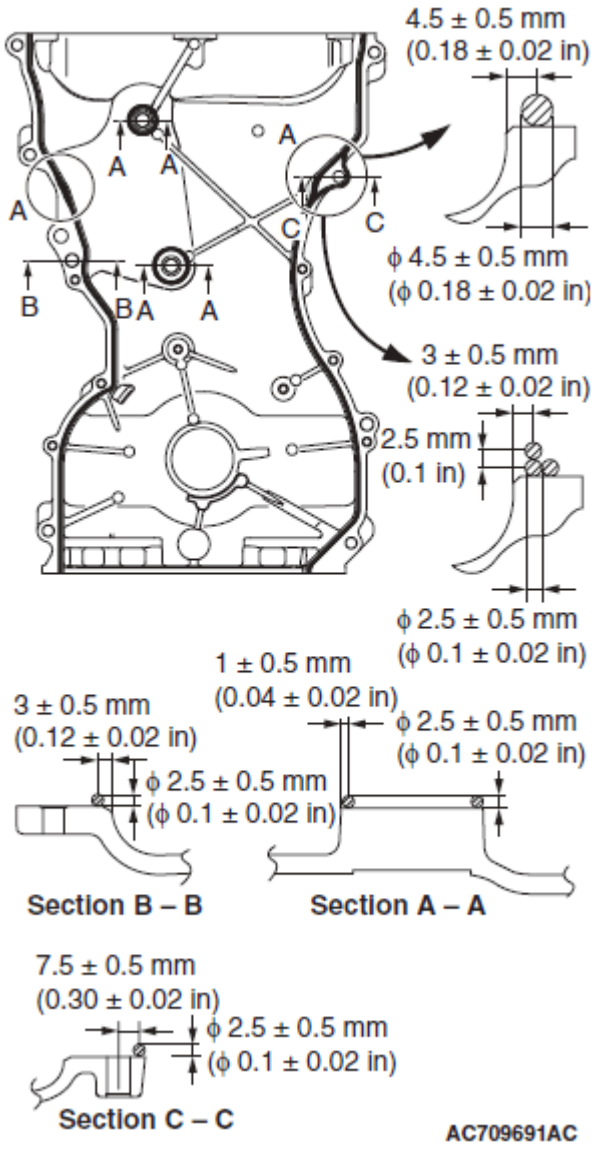


Fig. 130: Identifying Timing Chain Case Assembly To Sealant Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

TIGHTENING TORQUE SPECIFICATION CHART

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)

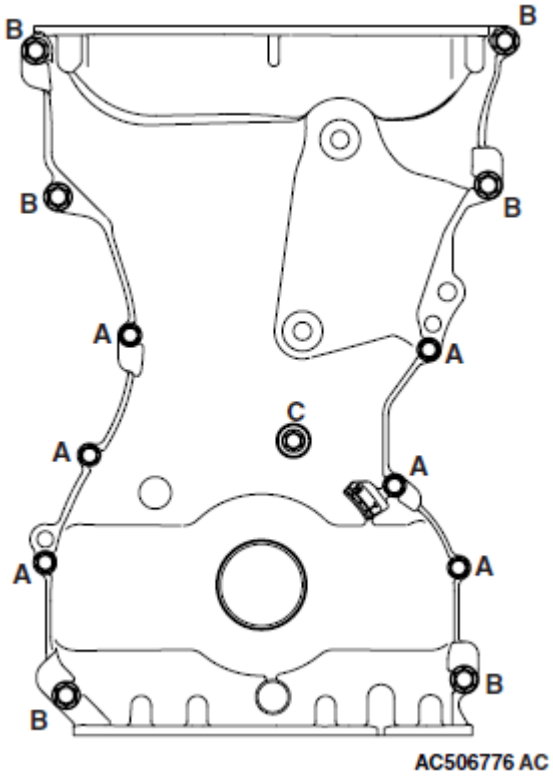


Fig. 131: Identifying Timing Chain Case Assembly And Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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)

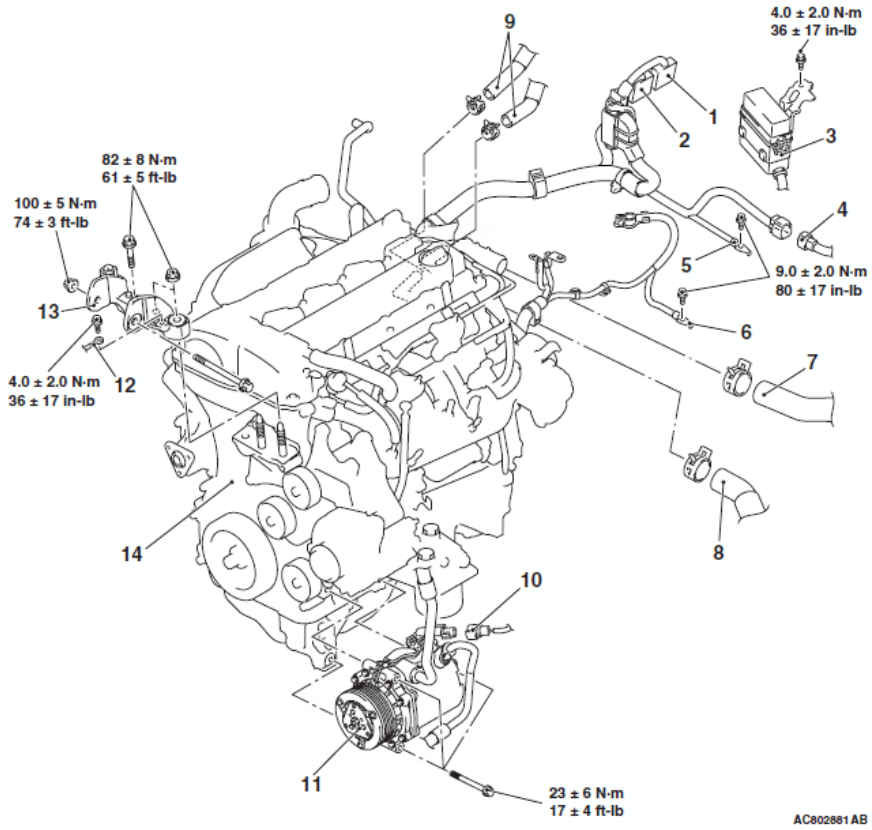
ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

CAUTION:
- **When the engine assembly is replaced, initialize the learned value using scan tool (Refer to INITIALIZATION PROCEDURE OF MFI ENGINE LEARNED VALUE .)**

- **Before replacing the steering wheel assembly and driver's air bag module assembly, always refer to SERVICE PRECAUTIONS and AIR BAG MODULE(S) AND CLOCK SPRING . Also, position the front wheels in a straight ahead direction, and remove the ignition key. If you fail to do this, clock spring for SRS may get damage, making the SRS (air bag) inoperative, and it may cause a serious injury to the driver.**
- **After adjusting the wheel alignment, always perform calibration to make the ASC-ECU learn the neutral position of the steering wheel sensor (Refer to STEERING WHEEL SENSOR CALIBRATION .)**

Pre-removal Operation	Post-installation Operation
• Fuel Line Pressure Reduction	• Battery and Battery Tray Installation
• Engine Room Under Cover Front A, B and Engine Room Side Cover Removal	• Air Cleaner Assembly Installation
• Engine Coolant Draining	• Charge Air Cooler Intake Hose A Installation
• Engine Oil Draining	• Strut Tower Bar Installation
• Strut Tower Bar Removal	• Engine Oil Refilling
• Charge Air Cooler Intake Hose A Removal	• Engine Coolant Refilling
• Air Cleaner Assembly Removal	• Fuel Leak Check. • Engine Room Under Cover Front and Engine Room Side Cover Installation
• Battery and Battery Tray Removal	



Removal steps

- Power steering oil pump assembly

<<B>> >>B<<

1. Joint connector (CAN 4) connection
2. Front wiring harness and control wiring harness combination connector connection
3. Relay box
4. Front wiring harness and control wiring harness combination connector connection
5. Grounding connection
6. Grounding connection

Removal steps (Continued)

10. A/C compressor assembly connector connection
11. A/C compressor and clutch assembly

- Hood assembly
- Radiator condenser tank bracket
- Fuel pump resistor

12. Grounding cable connection

- Transaxle assembly

Fig. 132: Identifying Engine Assembly Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

REMOVAL SERVICE POINTS

<<A>> RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

Make mating marks on the radiator hose and the hose clamp as shown to install them in the original position. Then, remove them.

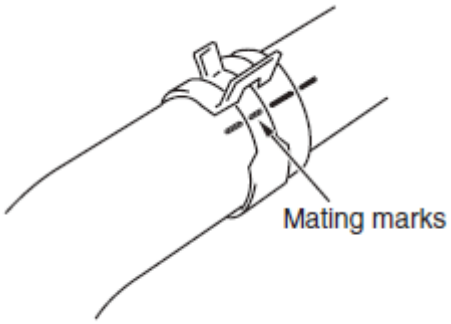


Fig. 133: Identifying Mating Marks On Radiator Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> 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.

<<C>> ENGINE MOUNTING BRACKET/ENGINE ASSEMBLY REMOVAL

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

1. Place a garage jack against the engine oil pan with a piece of wood in between to support the engine assembly.
2. Remove special tool MB991928 or MB991895 which was installed for supporting the engine assembly when the transaxle assembly was removed (Refer to **TRANSAXLE ASSEMBLY** .)

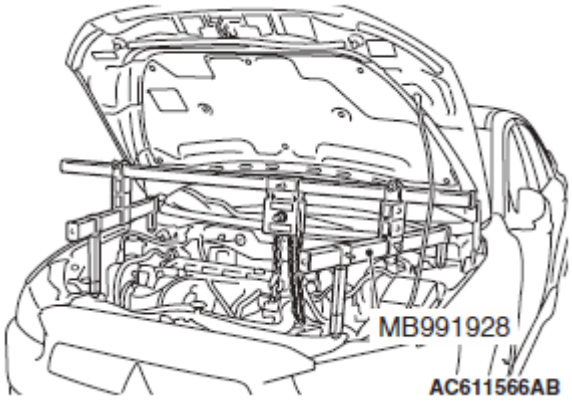


Fig. 134: Supporting Engine Assembly Using Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

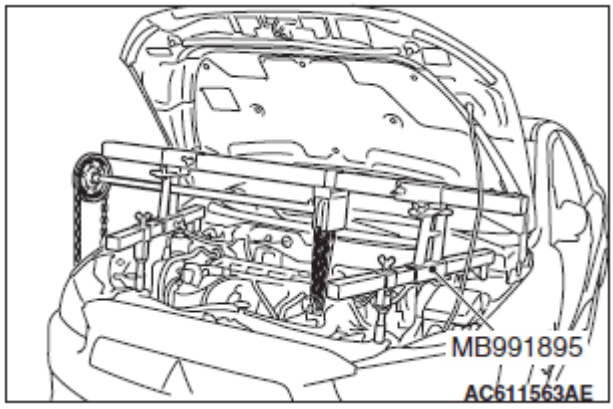


Fig. 135: Supporting Engine Assembly Using Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set special tool MB991454 to the engine hanger and the power steering oil pump bracket.

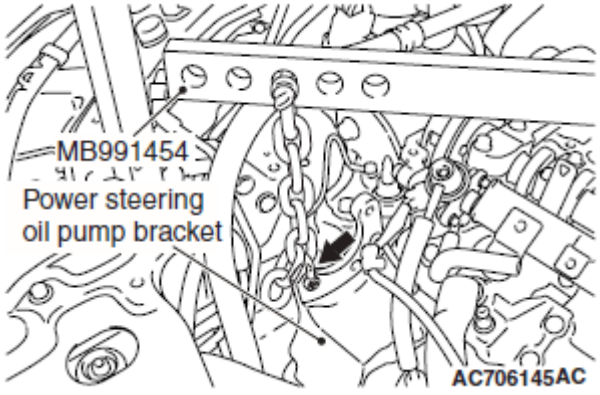


Fig. 136: Identifying Power Steering Oil Pump Bracket To Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Hold the engine assembly with a chain block.
5. Place a garage jack against the engine oil pan with a piece of wood in between, and remove the engine mounting bracket while adjusting the position of the engine.
6. After checking that all cables, hoses and wiring harness connectors and so on are disconnected from the engine, raise the vehicle slowly with a lift, and remove the engine assembly downwards from the engine compartment.

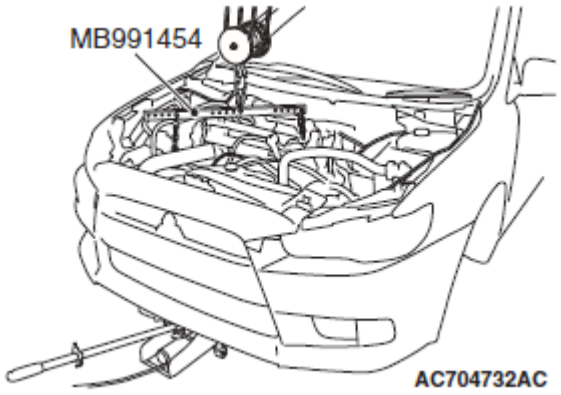


Fig. 137: Holding Engine Assembly With Chain Block Using Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< ENGINE ASSEMBLY/ENGINE MOUNTING BRACKET INSTALLATION

1. Place the engine assembly below the lifted vehicle.
2. Install the engine assembly, being careful not to pinch the cables, hoses, or wiring harness connectors.
3. Set special tool MB991454 and a chain block to the engine assembly.

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

4. 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.
5. Remove the chain block.

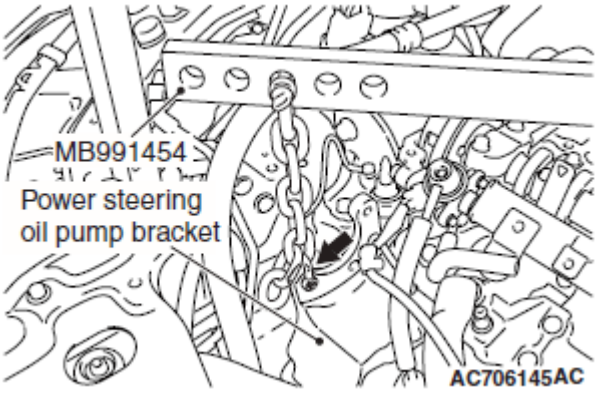


Fig. 138: Identifying Power Steering Oil Pump Bracket To Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

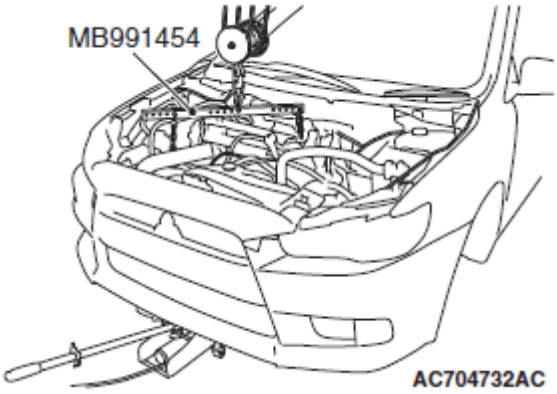


Fig. 139: Holding Engine Assembly With Chain Block Using Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Install special tool MB991928 or MB991895 which is used during installation of transaxle assembly to hold the engine assembly (Refer to **TRANSAXLE ASSEMBLY** .)
7. Remove the garage jack.

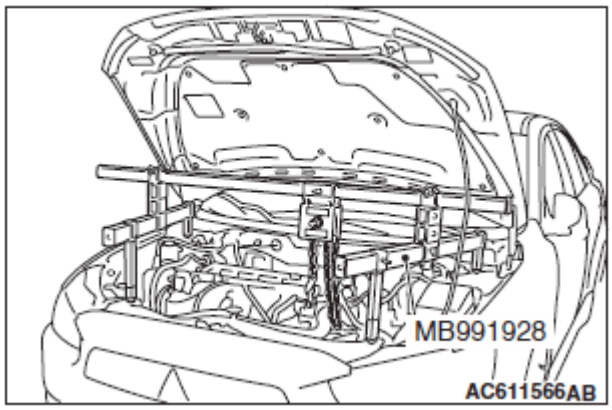


Fig. 140: Supporting Engine Assembly Using Special Tool MB991928

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

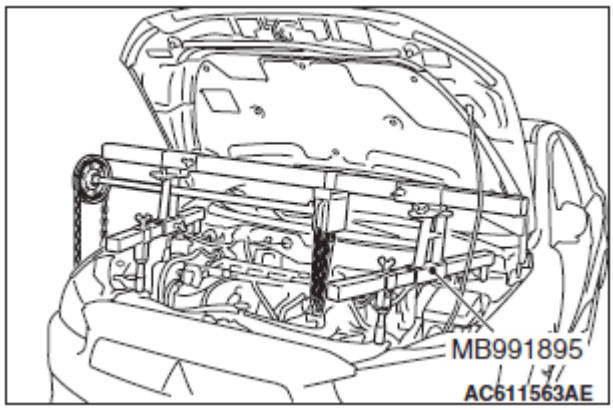


Fig. 141: Supporting Engine Assembly Using Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< 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)

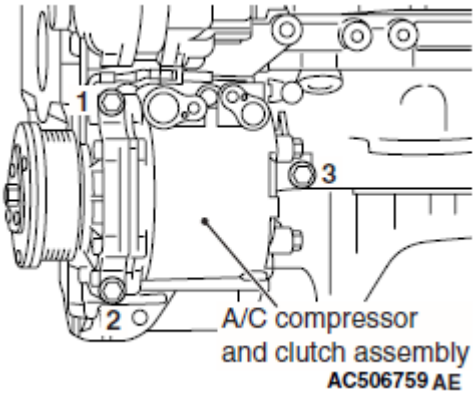


Fig. 142: Identifying A/C Compressor And Clutch Assembly Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

1. Insert radiator hose as far as the projection of the water inlet fitting or water outlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

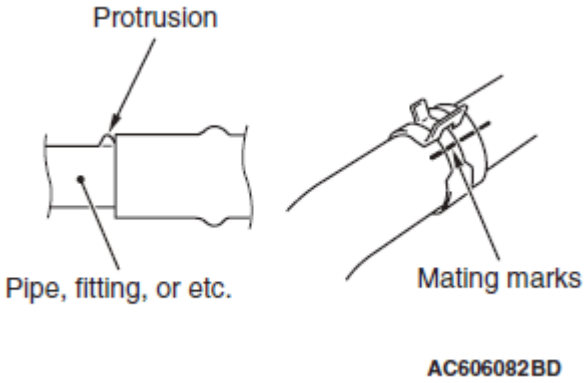


Fig. 143: Identifying Mating Marks On Radiator Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

