2013 ENGINE

Mechanical - 2.0L - Lancer Evolution

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 SPECIFICATION

ITEM			SPECIFICATION
Type			In-line DOHC
Number of cylinders			4
Bore mm (in)			86 (3.39)
Stroke mm (in)			86 (3.39)
Total displacement cm^3 (cu. in)			1, 998 (121.9)
Compression ratio			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

SYMPTOM CHART

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

Item		Standard value	Limit
Drive belt tension	Vibration frequency Hz (Reference)	97 - 124	-
	Tension N (lb) (Reference)	262 - 430 (59 - 97)	-
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 750 (109)
Compression pressure difference of all cylinder kPa (psi)		-	100 (14)
Intake manifold vacuum at curb idle kPa (in Hg)		-	Minimum 60 (18)

SEALANTS AND ADHESIVE

ITEM SPECIFICATION

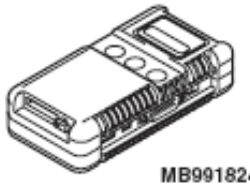
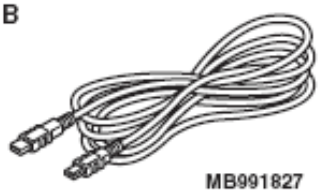
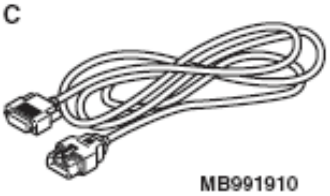
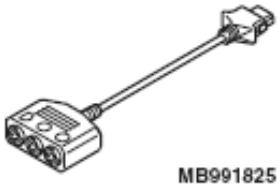
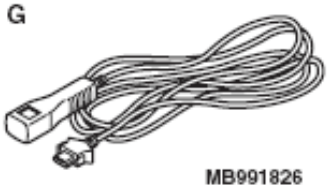
Item	Specified sealant	Remark
Rocker cover assembly (matching area of the cylinder head and the timing chain case)	ThreeBond 1227D, ThreeBond 1217G (Mitsubishi Genuine Part No. 1000A923), LOCTITE 5900 or equivalent	Semi-drying sealant
Engine oil pan	ThreeBond 1227D, ThreeBond 1217G (Mitsubishi Genuine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

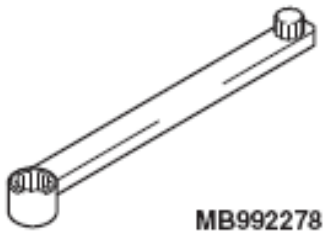
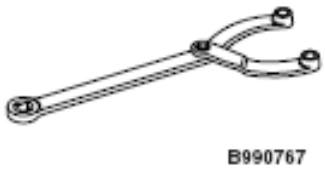
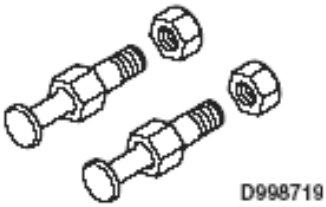
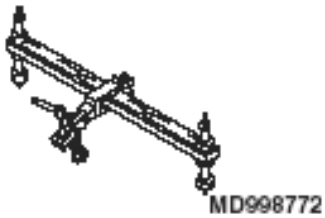
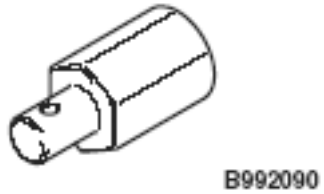
Flywheel bolt	Three bond 1324 equivalent	Anaerobic adhesive
Crankshaft rear oil seal case	ThreeBond 1227D, ThreeBond 1217G (Mitsubishi Genuine Part No. 1000A923), ThreeBond 1207F (Mitsubishi Genuine Part No. 1000A992), LOCTITE 5970, LOCTITE 5900 or equivalent	Semi-drying sealant
Cylinder head gasket (matching area of the cylinder head, cylinder head gasket and the cylinder block)	Three bond 1217G (Mitsubishi Genuine Part No. 1000A923), LOCTITE 5900 or equivalent	
Timing chain case assembly		

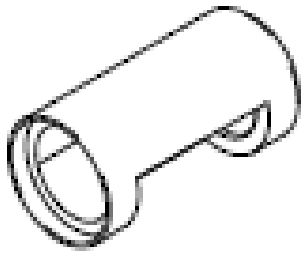
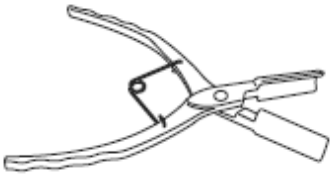
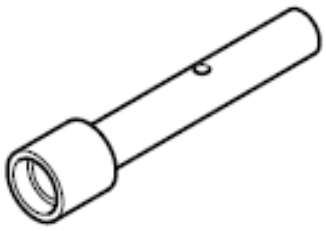
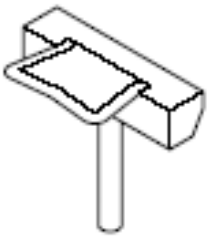
SPECIAL TOOLS

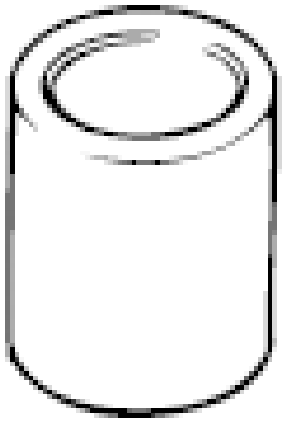
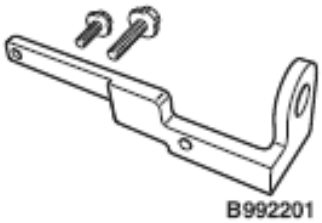
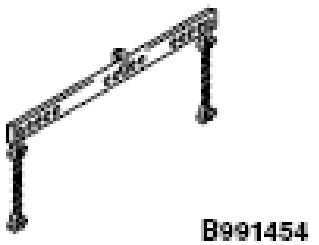
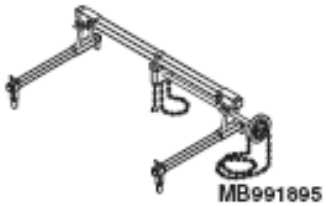
SPECIAL TOOLS REFERENCE

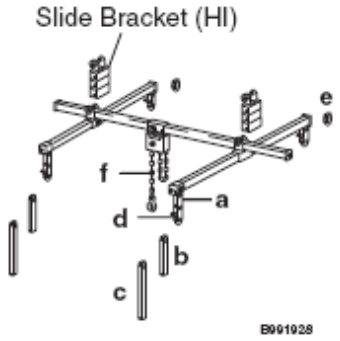
Tool	Tool number and name	Supersession	Application
	MB992080 Belt tension meter set a. MB992081 Belt tension meter b. MB992082 Mic assembly	Tool not available	Drive belt tension (frequency) measurement
	MB991958 Scan tool (M.U.T.-III sub assembly) a. MB991824 Vehicle communication interface (V.C.I.) b. MB991827 M.U.T.-III USB cable c. MB991910 M.U.T.-III main harness A (Vehicles with		**CAUTION:**

A  MB991824 B  MB991827 C  MB991910 D  MB991911 E  MB991914 F  MB991825 G  MB991826 MB991958	CAN communication system) d. MB991911 M.U.T.-III main harness B (Vehicles without CAN communication system) e. MB991914 M.U.T.-III main harness C (for Chrysler models only) f. MB991825 M.U.T.-III adapter harness g. MB991826 M.U.T.-III trigger harness	MB991824-KIT **NOTE:** **MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.**	**For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** • Standard ignition timing check • Idle speed check
	MB992278 Belt tension release wrench		Auto-tensioner tension release

 MB992278			
 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	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

			
 B992201	MB992201 Engine hanger plate	-	Support of engine and transaxle assembly
 B991454	MB991454 Engine hanger balancer	MZ203827-01	Support of engine assembly
 MB991895	MB991895 Engine hanger	Tool not available	
	MB991928 Engine hanger a. MB991929 Joint (50) x 2 b. MB991930 Joint (90) x 2		

	c. MB991931 Joint (140) x 2 d. MB991932 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. (Refer to **RADIATOR**).

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

2. Make sure that the indicator mark on the auto-tensioner is within the area marked with A in the illustration.

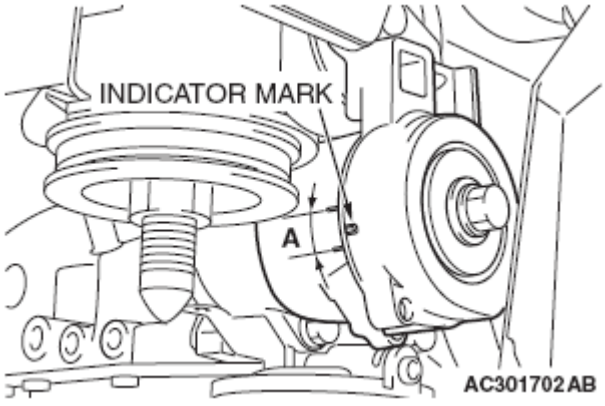


Fig. 1: Indicator Mark On Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. 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.

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

AUTO-TENSIONER CHECK

OPERATION CHECK

Required Special Tool:

MB992278: Belt tension release wrench

1. Stop the engine from the idle state.
2. Remove the radiator condenser tank. (Refer to **RADIATOR**).
3. Check that the drive belt is not protruding from the pulley width of the auto-tensioner.
4. Remove the drive belt (Refer to **<<A>> DRIVE BELT REMOVAL**).

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

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

WARNING: Be sure to set the box-type wrench and the special tool MB992278 to the hexagonal parts securely to prevent the tool from falling off because the tension of the auto-tensioner is high.

5. Install special tool MB992278 and a box-type wrench at the optimum angle.

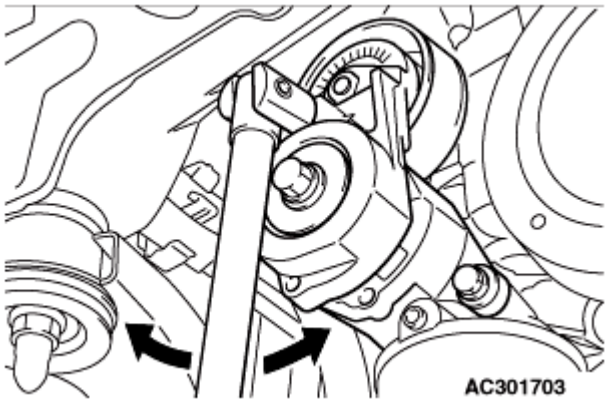


Fig. 2: Turning Auto-Tensioner

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Check that no binding is present by turning the auto-tensioner in the left and right directions.
7. If there are any problems in the procedure 3 or 6, replace the auto-tensioner. (Refer to **<<D>> AUTO-TENSIONER REMOVAL**).
8. Install the drive belt. (Refer to **>>B<< DRIVE BELT INSTALLATION**).
9. Install the radiator condenser tank. (Refer to **RADIATOR**).

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 microphone assembly (MB992082) to special tool belt tension meter (MB992081) of special tool belt tension meter set (MB992080).

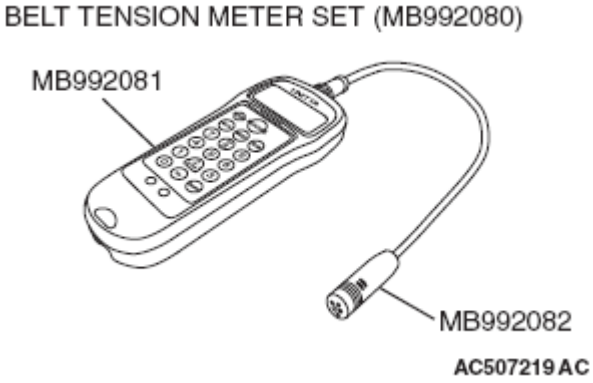


Fig. 3: Connecting Special Tool Microphone Assembly To Special Tool Belt Tension Meter
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

   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).

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 degrees 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 below, and check that the vibration frequency of the belt is within the standard value.

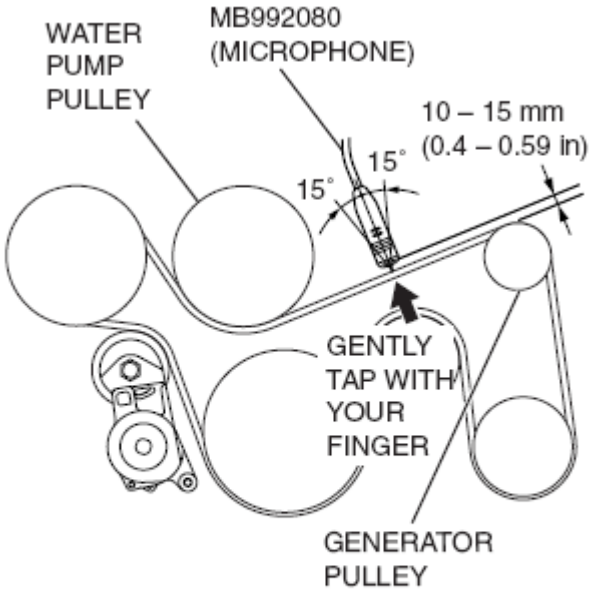


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Fig. 4: Checking Drive Belt Tension Using Belt Tension Meter & Drive Belt Routing Diagram
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Standard value: 97 - 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.

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 below (at the place indicated by the arrow) to check that the belt tension is within the standard value.

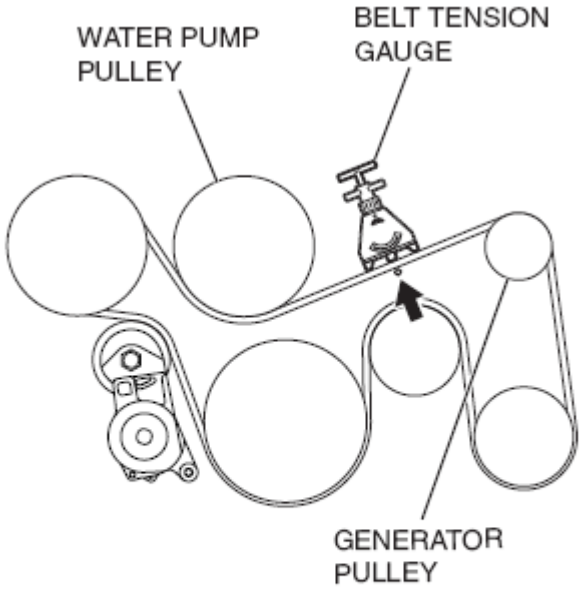

Fig. 5: Checking Drive Belt Tension Using Tension Gauge & Drive Belt Routing Diagram
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Standard value (Reference): 262 - 430 N (59 - 97 lb)

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

VALVE CLEARANCE CHECK AND ADJUSTMENT

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

IGNITION TIMING CHECK

Required Special Tool:

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

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

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

- Lights and all accessories: OFF
- Transaxle: Neutral (P range on vehicles with TC-SST)

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

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

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

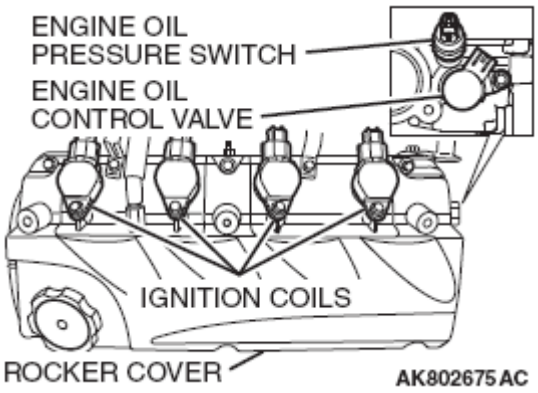

Fig. 6: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 4) of the ignition coil No. 1.

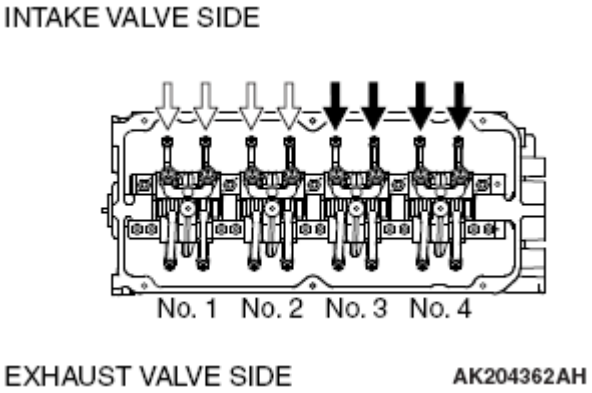

Fig. 7: No. 1 Ignition Coil & Equipment Side Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 **SYMPTOM CHART** .

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

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

    Standard value: Approximately 10° BTDC

    NOTE: 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: Neutral (P range on vehicles with TC-SST)

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.

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

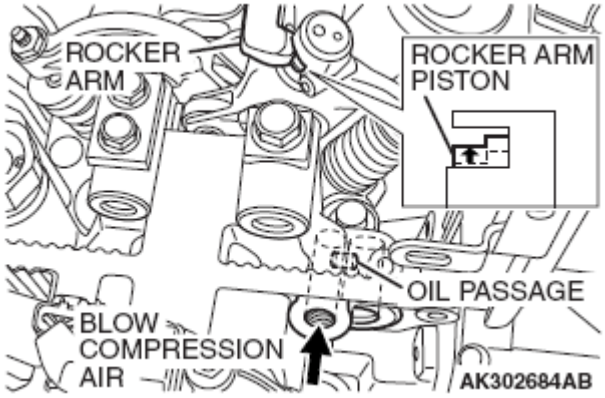


Fig. 8: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 4) of the ignition coil No. 1.

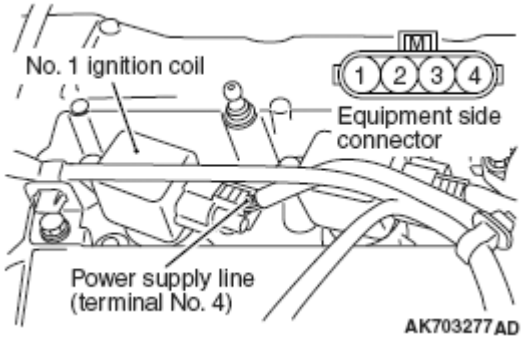


Fig. 9: No. 1 Ignition Coil & Equipment Side Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

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

   Curb idle speed: 700 ± 100 r/min

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

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

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

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

IDLE MIXTURE CHECK

Required Special Tool:

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

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

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

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

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

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

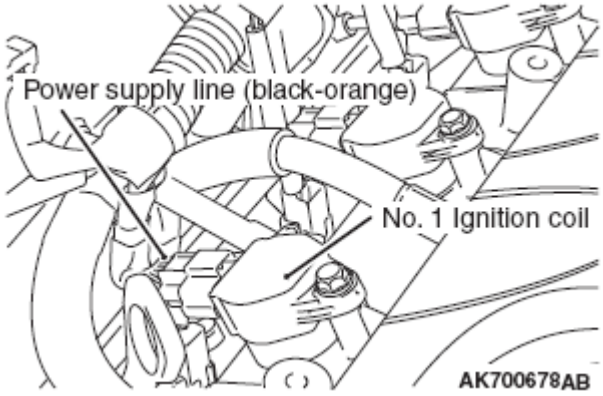


Fig. 10: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 4) of the ignition coil No. 1.

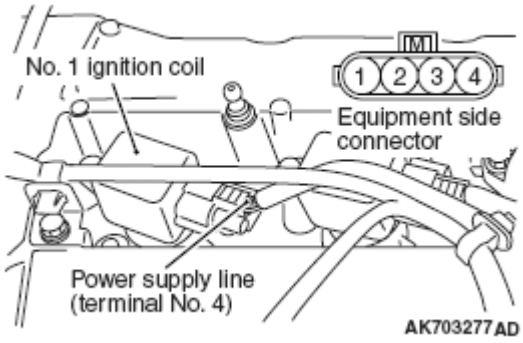


Fig. 11: No. 1 Ignition Coil & Equipment Side Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

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

   Standard value:

   CO contents: 0.5% or less

   HC contents: 100 ppm or less

9. If there is a deviation from the standard value, inspect the MFI system (Refer to **SYMPTOM CHART**)
10. Remove the CO, HC tester and timing light.

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

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

COMPRESSION PRESSURE CHECK

Required Special Tool:

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

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

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

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

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

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

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

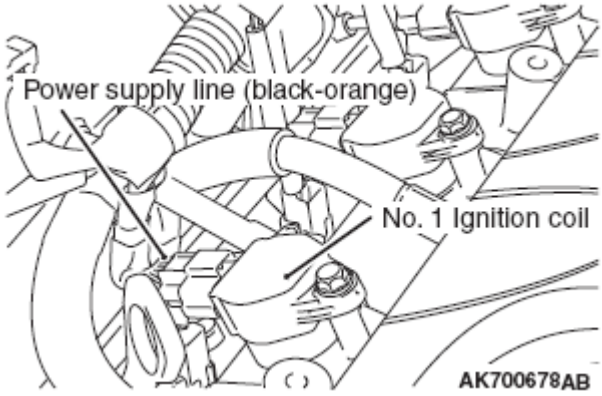


Fig. 12: Injector Connectors
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Set compression gauge to one of the spark plug holes.

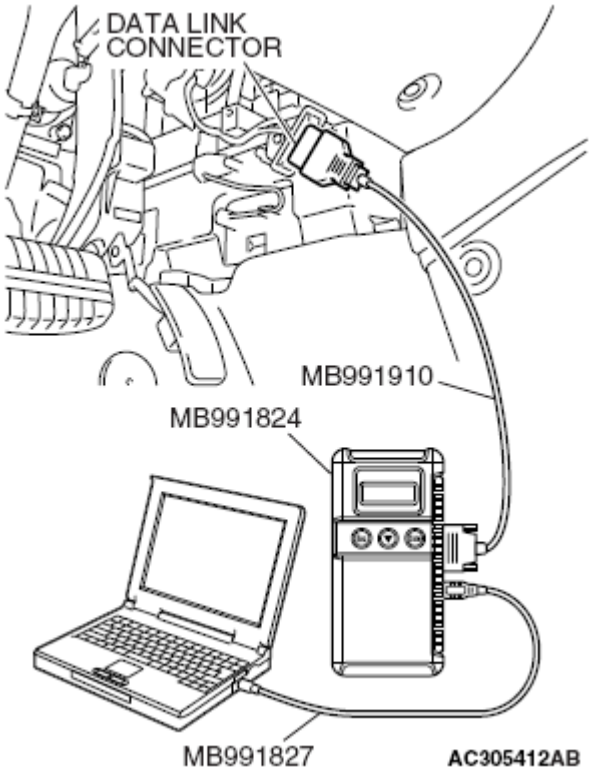


Fig. 13: Setting Compression Gauge To Spark Plug Holes
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. 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)

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

   Limit: Maximum 100 kPa (14 psi)

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

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

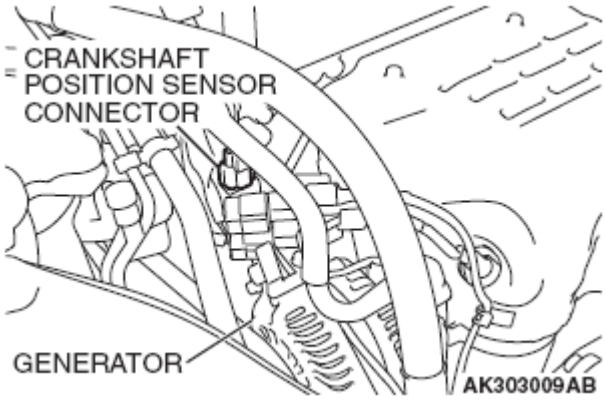


Fig. 14: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

MANIFOLD VACUUM CHECK

Required Special Tool:

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

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

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

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

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

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

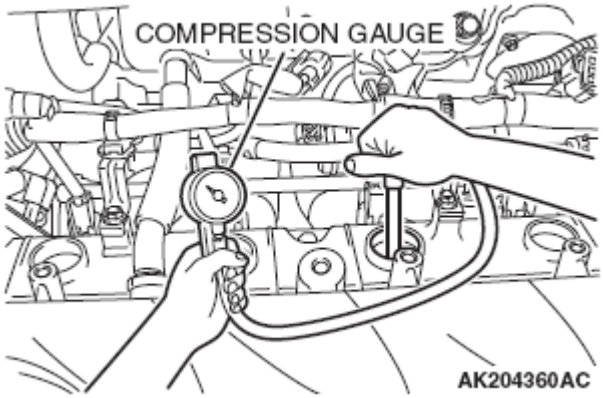


Fig. 15: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose. Plug the PCV valve.

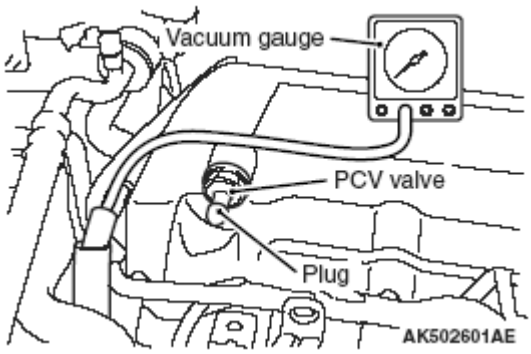


Fig. 16: Connecting Vacuum Gauge To Ventilation Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

TIMING CHAIN ELONGATION VISUAL CHECK

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

NOTE: After the following diagnostic trouble codes are repaired, it is necessary to delete the learning value of the timing chain elongation. At that time, perform the visual check.

- **DTC P0016: Crankshaft/Camshaft (intake) Position Sensor Phase Problem**
- **DTC P0017: Crankshaft/Camshaft (exhaust) Position Sensor Phase Problem**

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 diagnosis 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 below. As a result of this, the No. 1 cylinder is positioned at the compression TDC.

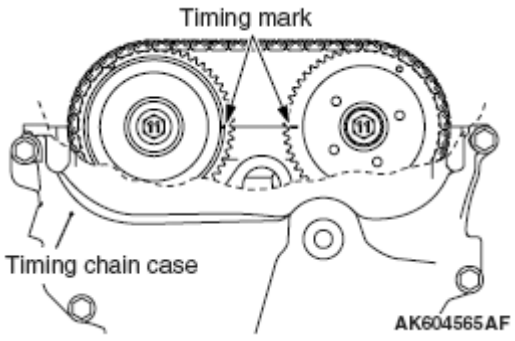


Fig. 17: Timing Mark Of Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Look at the inside of timing chain case with one eye in the direction of arrow shown in the illustration below. 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.

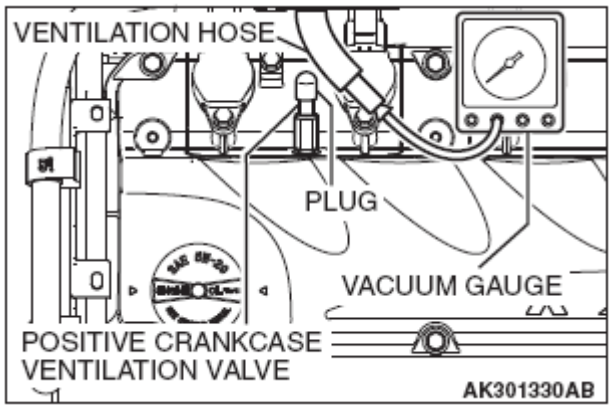
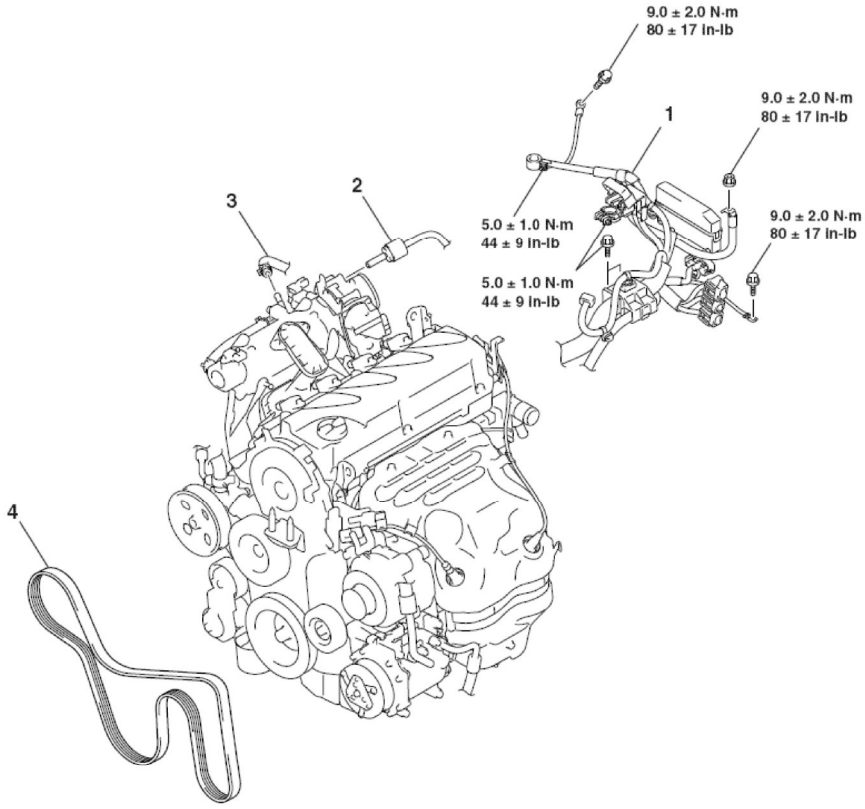


Fig. 18: Locating Timing Chain Case
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal • Fuel Line Pressure Reduction • Engine Oil Draining • Engine Coolant Draining • Transmission Oil Draining • Transmission Fluid Draining • Hood Removal • ECM <M/T> or PCM <A/T> Removal • Air Cleaner Removal • Battery and Battery Tray Removal • Radiator Assembly Removal • Front No.1 Exhaust Pipe Removal • Front No.2 Exhaust Pipe Removal	• Front No.2 Exhaust Pipe Installation • Front No.1 Exhaust Pipe Installation • Radiator Assembly Installation • Battery and Battery Tray Installation • Air Cleaner Installation • ECM <M/T> or PCM <A/T> Installation • Hood Installation • Transmission Oil Refilling • Transmission Fluid Refilling • Engine Coolant Refilling • Engine Oil Refilling • Fuel Leak Check • Drive Belt Tension Check • Side Under Cover Installation • Front Wheel Alignment Check and Adjustment



REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. EVAPORATIVE EMISSION PURGE HOSE CONNECTION

<<A>> >>E<< >>F<<

3. BRAKE BOOSTER VACUUM HOSE CONNECTION
4. DRIVE BELT

Fig. 19: Checking End Top Point "A" Of Timing Chain Cross Section Surface
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. Install the upper chain guide.

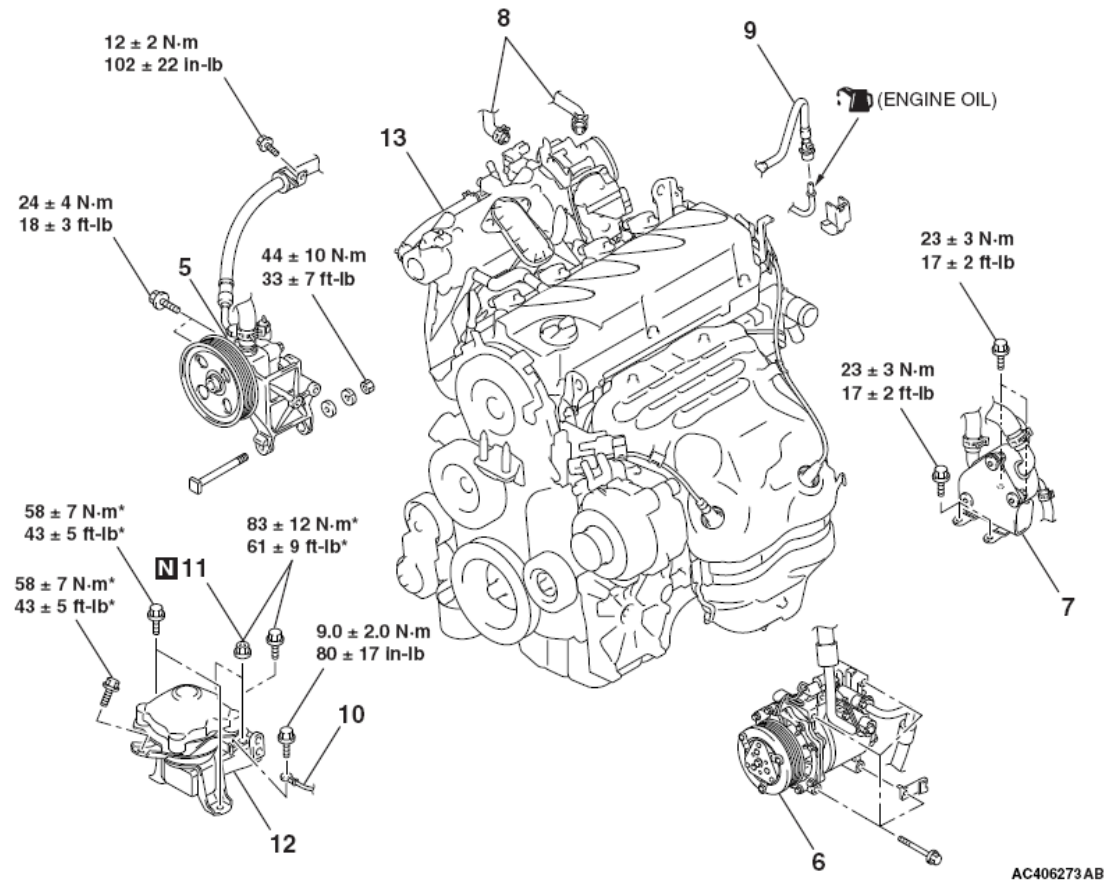
CAUTION: Completely clean the old FIPG remaining in the clearance between the mating parts.

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 below.

Specified sealant: THREE BOND 1217G or equivalent.



REMOVAL STEPS

<<B>>	5.	POWER STEERING OIL PUMP AND BRACKET ASSEMBLY	<<F>> >>C<<	•	TRANSAXLE ASSEMBLY
<<C>>	6.	A/C COMPRESSOR AND CLUTCH ASSEMBLY		10.	GROUNDING CABLE CONNECTION
<<D>>	7.	ATF WARMER (TRANSMISSION FLUID COOLER) AND BRACKET ASSEMBLY <A/T>	<<G>>	•	POWER STEERING OIL RESERVOIR
	8.	HEATER WATER HOSES CONNECTION	<<H>> >>B<<	11.	JAM NUTS
<<E>> >>D<<	9.	FUEL HIGH-PRESSURE HOSE CONNECTION	<<I>> >>A<<	12.	ENGINE FRONT MOUNTING BRACKET
				13.	ENGINE ASSEMBLY

Fig. 20: Identifying Liquid Gasket Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

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

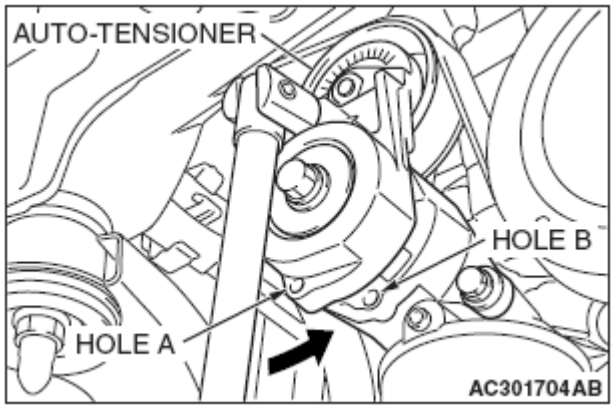


Fig. 21: Cylinder Head Cover Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 diagnosis code No. P0012 is output.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

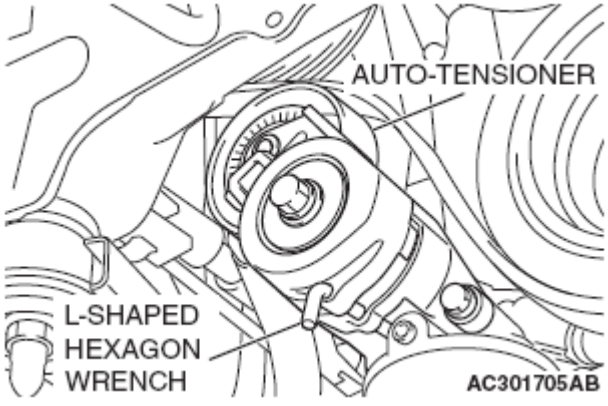


Fig. 22: Crankshaft Pulley Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB992278: Belt Tension Release Wrench

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

REMOVAL SERVICE POINTS

<<A>> DRIVE BELT REMOVAL

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

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

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

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

WARNING: Be sure to set the box-type wrench and the special tool MB992278 to the hexagonal parts securely to prevent the tool from falling off because the tension of the auto-tensioner is high.

1. Install special tool MB992278 and a box-type wrench at the optimum angle.

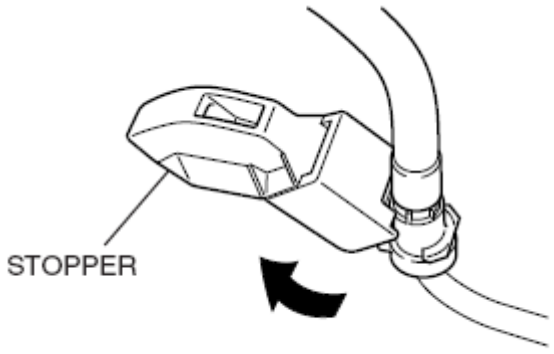


Fig. 23: Rotating Pulley Bolt Of Auto-Tensioner Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Rotate the pulley bolt of the auto-tensioner counterclockwise.
3. Insert the L-shaped hexagon wrench into the auto-tensioner hole to fix the auto-tensioner.

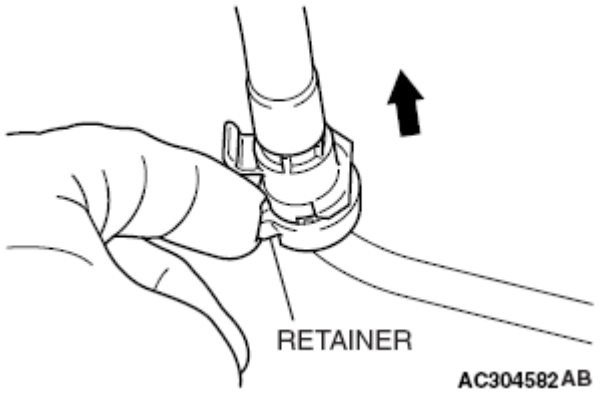


Fig. 24: Identifying L-Shaped Hexagon Wrench In Auto-Tensioner Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Remove the drive belt.

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

1. Hold the crankshaft drive sprocket with special tools MB990767 and MD998719.

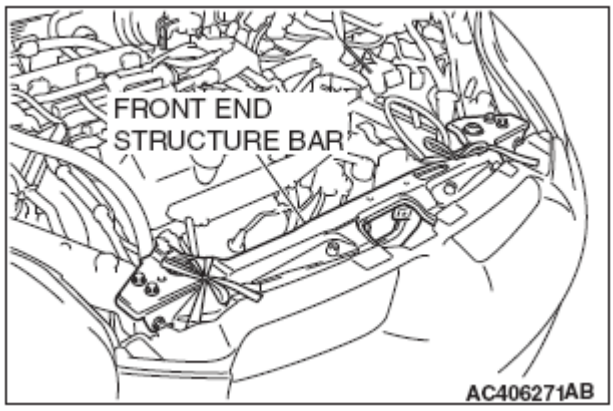


Fig. 25: Holding Crankshaft Drive Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Loosen the crankshaft pulley center bolt and remove the crankshaft pulley center bolt and crankshaft pulley washer.

INSTALLATION SERVICE POINTS

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

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

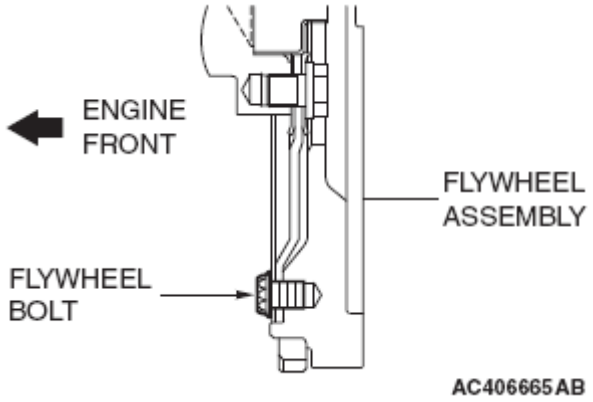


Fig. 26: Crankshaft Pulley, Crankshaft Pulley Washer & Crankshaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

3. Install the crankshaft pulley.
4. Wipe off the dirt on the crankshaft pulley washer and the crankshaft pulley center bolt as shown in the illustration above using a rag.
5. Apply an adequate and minimum amount of engine oil to the threads of the crankshaft pulley center bolt and the lower area of the flange.
6. Hold the crankshaft pulley with special tools MB990767 and MD998719 in the same manner as removal.

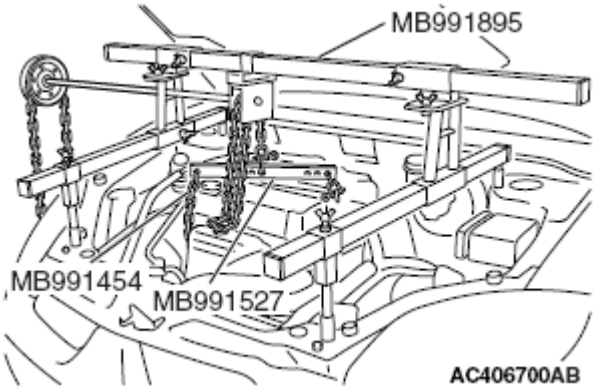


Fig. 27: Holding Crankshaft Drive Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. Tighten the crankshaft pulley center bolt according to the following procedure.
    1. Tighten the crankshaft pulley center bolt to the specified torque 250 N.m (184 ft-lb).
    2. Loosen the crankshaft pulley center bolt fully.
    3. Tighten the crankshaft pulley center bolt to the specified torque 110 N.m (81 ft-lb).
    4. As shown in the illustration below "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.

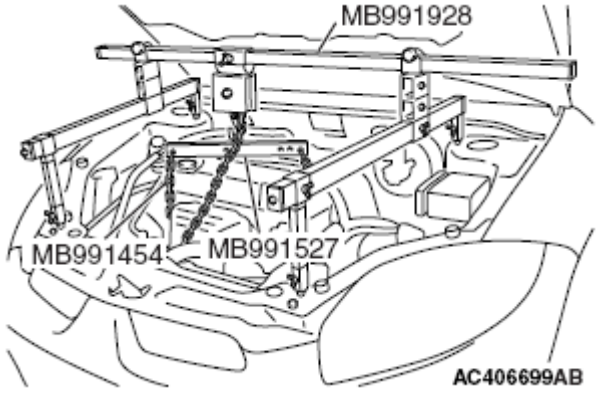


Fig. 28: Crankshaft Pulley Center Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 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 above "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.**

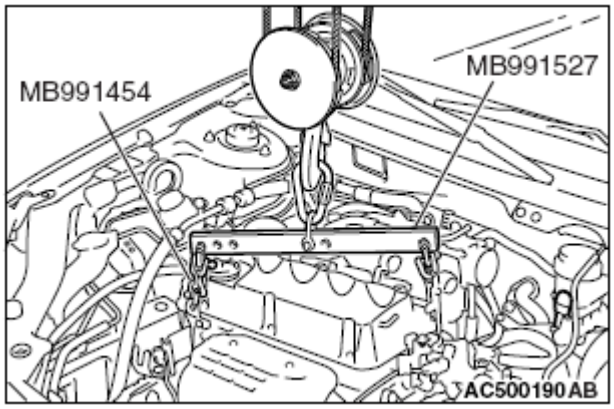


Fig. 29: Checking Drive Belt Installation Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

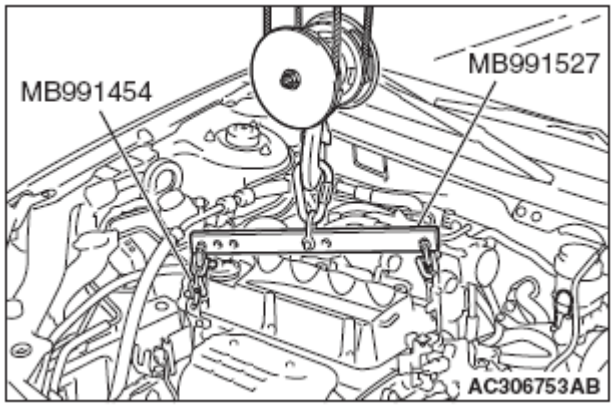


Fig. 30: Identifying Drive Belt Routing
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

WARNING: Be sure to set the box-type wrench and the special tool MB992278 to the hexagonal parts securely to prevent the tool from falling off because the tension of the auto-tensioner is high.

2. Install special tool MB992278 and a box-type wrench at the optimum angle.

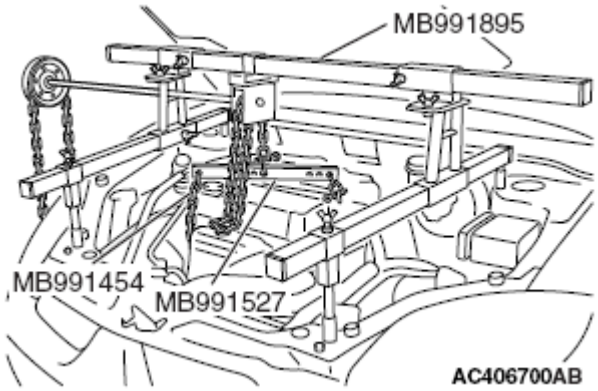


Fig. 31: Rotating Pulley Bolt Of Auto-Tensioner Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Rotate the auto-tensioner counterclockwise and remove the L-shaped hexagon wrench fixing the auto-tensioner.

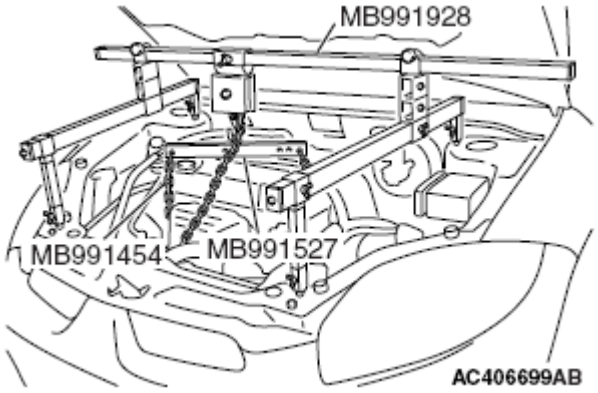


Fig. 32: Identifying L-Shaped Hexagon Wrench In Auto-Tensioner Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Apply tension to the drive belt while slowly turning the auto-tensioner clockwise.

CAMSHAFT

REMOVAL AND INSTALLATION

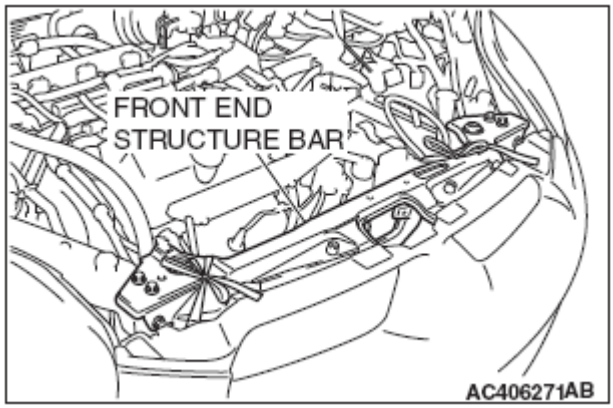


Fig. 33: Camshaft Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MB992103: Chain Tension Release Bar

REMOVAL SERVICE POINTS

<<A>> ROCKER COVER ASSEMBLY REMOVAL

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

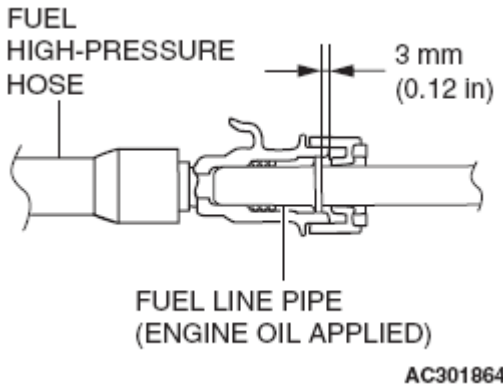


Fig. 34: Rocker Cover Mounting Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> CYLINDER NO. 1 COMPRESSION TOP DEAD CENTER SETTING

CAUTION: Turn the crankshaft clockwise.

1. Turn the crankshaft clockwise so that the camshaft sprocket timing marks become horizontal to the

cylinder head upper surface, and set the cylinder No. 1 to the top dead center of compression. At this time, check that the crankshaft pulley timing mark is in the 0-degree position of the ignition timing indicator of the timing chain case assembly.

2. Put paint marks on both the camshaft sprocket and timing chain at the position of camshaft sprocket timing chain mating mark (circular hole).

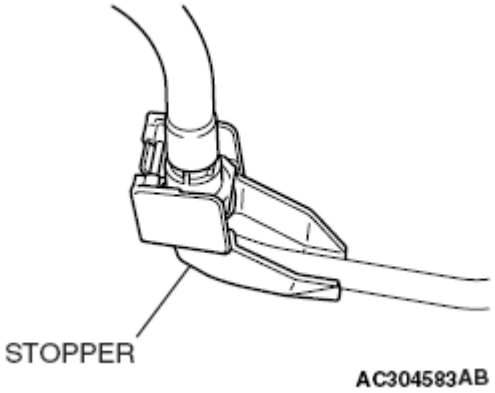


Fig. 35: Paint Marks On Camshaft Sprocket & Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

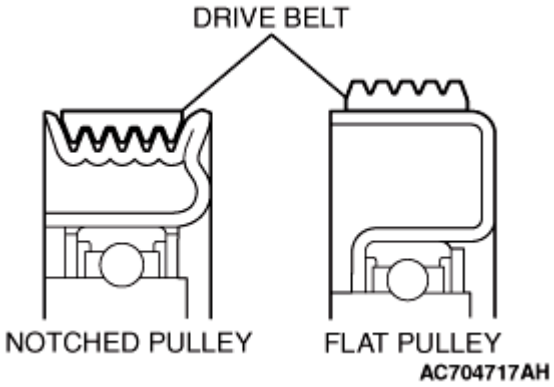


Fig. 36: Pressing Timing Chain Tensioner Ratchet
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

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. 38**).

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. 38), and the spread timing chain tension side guide can be held (Fig. 38).

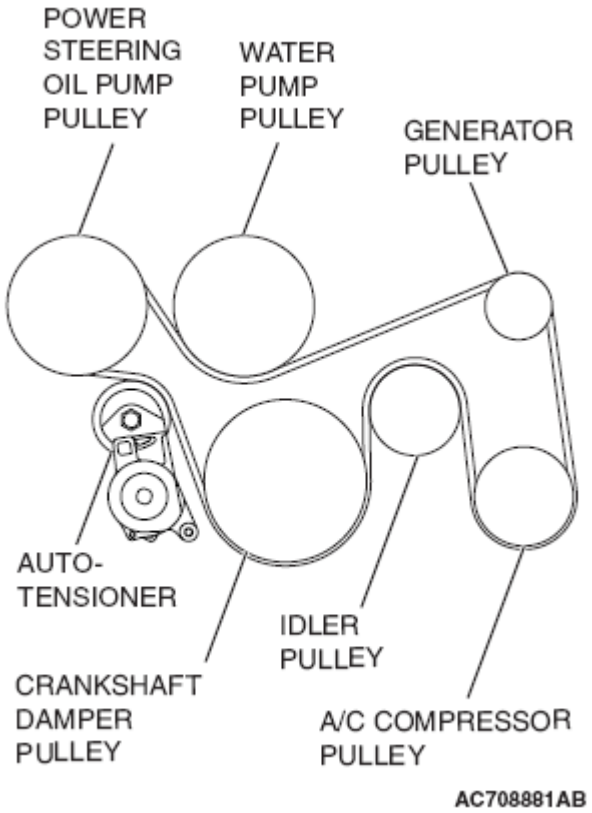


Fig. 37: Inserting Special Tool (MB992103) Tension Side Of Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. With the special tool MB992103 inserted up to the insertion guide line, press the special tool against the intake side camshaft sprocket and spread and hold the timing chain tension side guide.
4. Remove the flat-tipped precision screwdriver unlocking the timing chain tensioner.

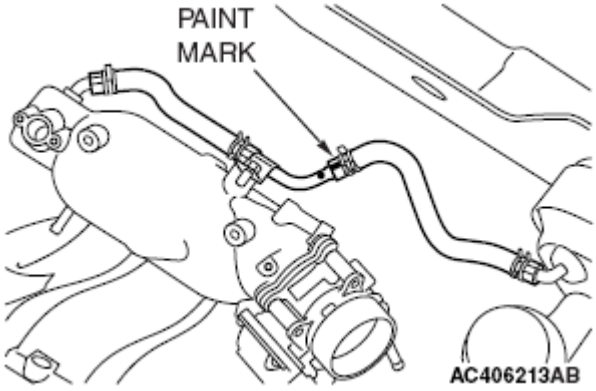
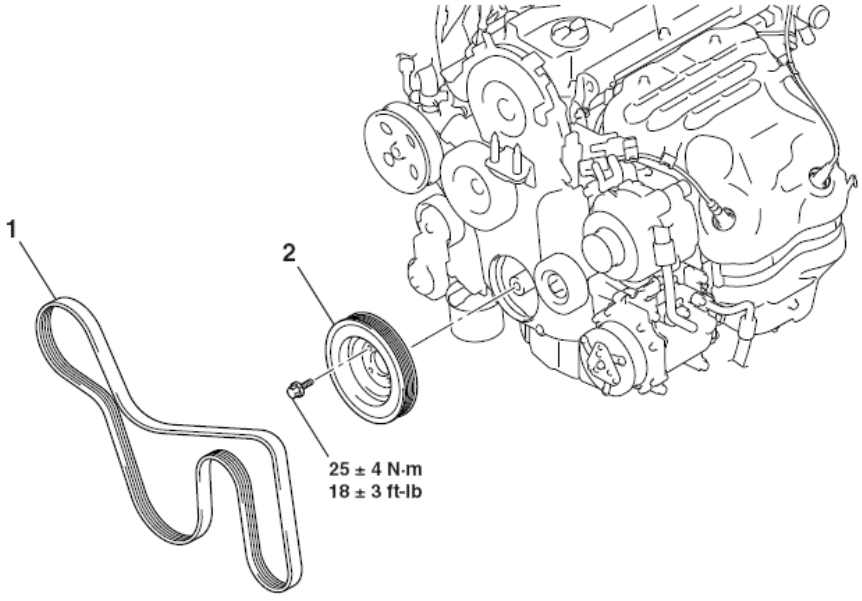


Fig. 38: Unlocking Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal	• Drive Belt Tension Check • Side Under Cover Installation



REMOVAL STEPS

<<**A**>> >>**A**<< 1. DRIVE BELT
2. CRANKSHAFT DAMPER PULLEY

Fig. 39: Turning Camshaft Clockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<D>> FRONT CAMSHAFT BEARING CAP ASSEMBLY REMOVAL

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

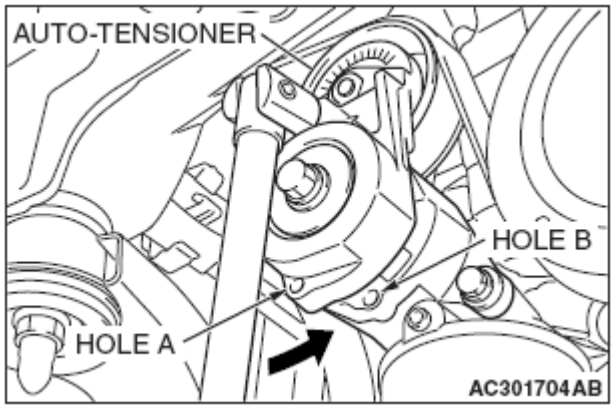


Fig. 40: Front Camshaft Bearing Cap Assembly Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

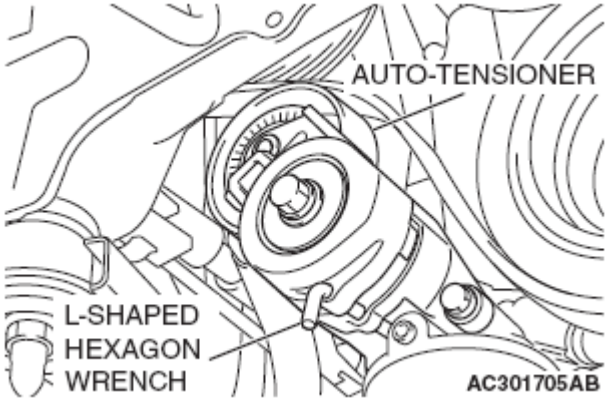


Fig. 41: Camshaft Bearing Cap Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

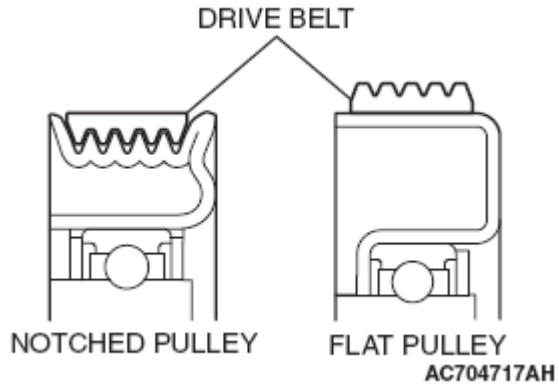


Fig. 42: Removing Camshaft & Camshaft Sprocket Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

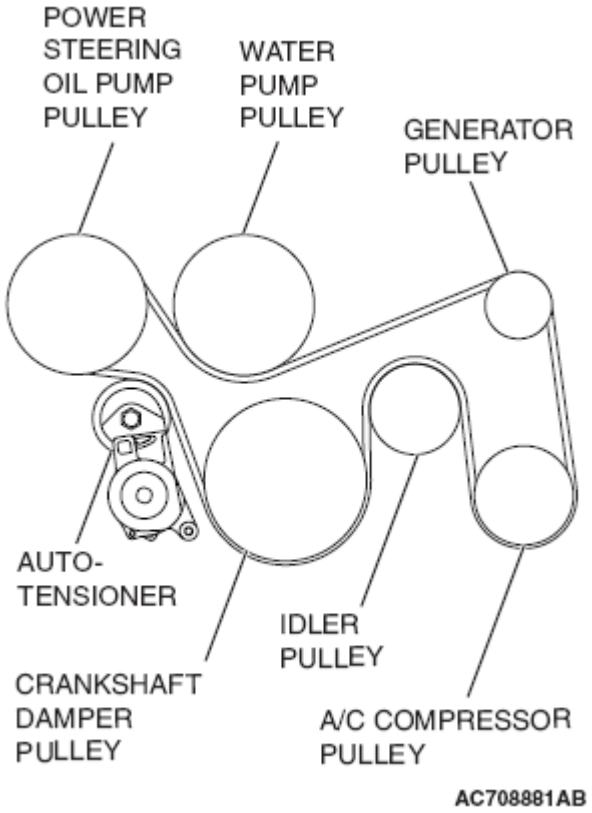
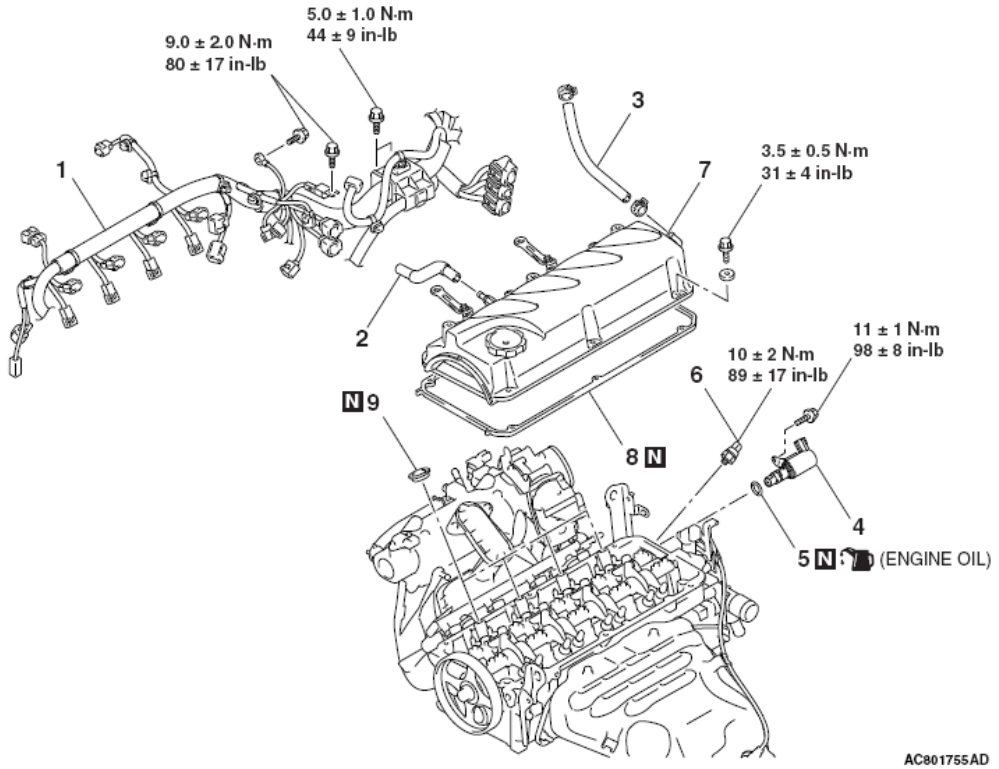


Fig. 43: Removing Timing Chain From Camshaft & Camshaft Sprocket Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

Pre-removal Operation	Post-installation Operation
• ECM <M/T> or PCM <A/T> Removal • Air Cleaner Removal • Battery and Battery Tray Removal • Ignition Coils Removal • Timing Belt Upper Cover Removal	• Timing Belt Upper Cover Installation • Ignition Coils Installation • Battery and Battery Tray Installation • Air Cleaner Installation • ECM <M/T> or PCM <A/T> Installation • Drive Belt Tension Check • Valve Clearance Check and Adjustment



CAMSHAFT REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. ROCKER COVER PCV HOSE
3. ROCKER COVER BREATHER HOSE

>>K<< 4. ENGINE OIL CONTROL VALVE

>>K<< 5. O-RING

CAMSHAFT REMOVAL STEPS

>>J<< 6. ENGINE OIL PRESSURE SWITCH

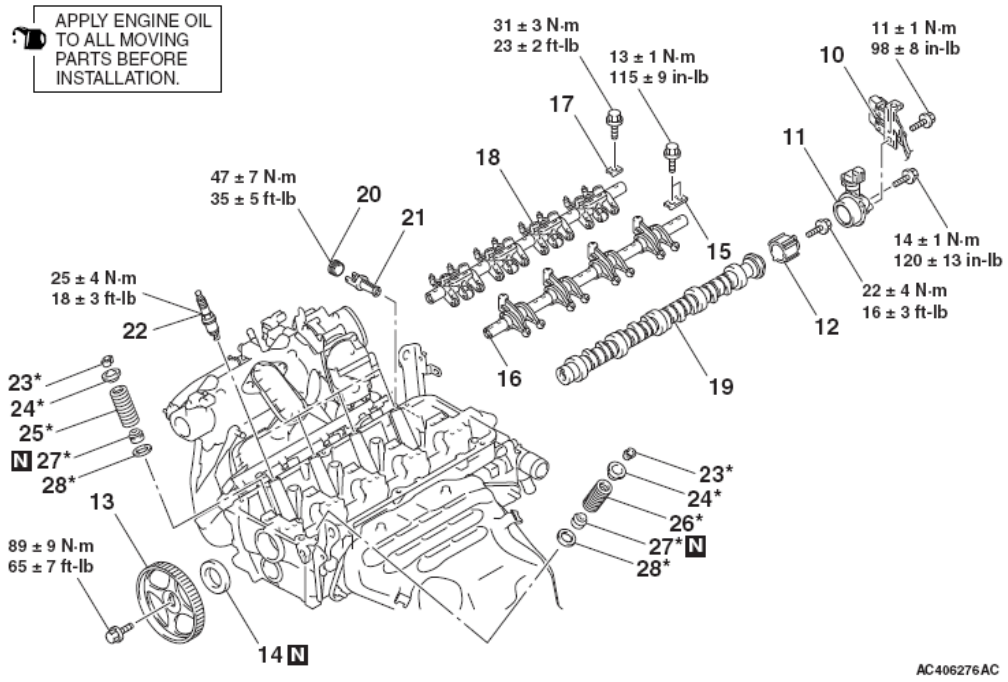
7. ROCKER COVER ASSEMBLY
8. ROCKER COVER GASKET
9. SPARK PLUG GUIDE OIL SEALS

• VALVE TIMING BELT

Fig. 44: Timing Chain & Rope
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<G>> CAMSHAFT SPROCKET/CAMSHAFT REMOVAL

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



CAMSHAFT REMOVAL STEPS

- 10. CONNECTOR BRACKET
- >>I<< 11. CAMSHAFT POSITION SENSOR SUPPORT
- 12. CAMSHAFT POSITION SENSING CYLINDER
- <<A>> >>H<< 13. CAMSHAFT SPROCKET
- >>G<< 14. CAMSHAFT OIL SEAL
- >>F<< 15. EXHAUST ROCKER ARM SHAFT CAPS
- <<B>> >>F<< 16. EXHAUST ROCKER ARM AND SHAFT ASSEMBLY
- >>E<< 17. INTAKE ROCKER ARM SHAFT CAPS
- <<B>> >>E<< 18. INTAKE ROCKER ARM AND SHAFT ASSEMBLY
- <<C>> >>D<< 19. CAMSHAFT
- • WATER INLET FITTING AND THERMOSTAT CASE ASSEMBLY
- 20. CYLINDER HEAD PLUG
- 21. ENGINE OIL CONTROL VALVE FILTER

VALVE STEM SEAL REMOVAL STEPS

- 1. CONTROL WIRING HARNESS CONNECTION
- 2. ROCKER COVER PCV HOSE
- 3. ROCKER COVER BREATHER HOSE
- 7. ROCKER COVER ASSEMBLY
- 8. ROCKER COVER GASKET
- 9. SPARK PLUG GUIDE OIL SEALS
- >>F<< 15. EXHAUST ROCKER ARM SHAFT CAPS
- <<B>> >>F<< 16. EXHAUST ROCKER ARM AND SHAFT ASSEMBLY
- >>E<< 17. INTAKE ROCKER ARM SHAFT CAPS
- <<B>> >>E<< 18. INTAKE ROCKER ARM AND SHAFT ASSEMBLY
- 22. SPARK PLUGS
- <<D>> >>C<< 23. VALVE SPRING RETAINER LOCKS
- 24. VALVE SPRING RETAINERS
- >>B<< 25. INTAKE VALVE SPRINGS
- >>B<< 26. EXHAUST VALVE SPRINGS
- >>A<< 27. VALVE STEM SEALS
- 28. VALVE SPRING SEATS

Fig. 45: Holding Hexagon Of Camshaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<H>> POWER STEERING OIL PUMP ASSEMBLY REMOVAL

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

<<I>> OIL FEEDER CONTROL VALVE REMOVAL

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

INSTALLATION SERVICE POINTS

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

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

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

>>B<< CAMSHAFT/CAMSHAFT SPROCKET INSTALLATION

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.

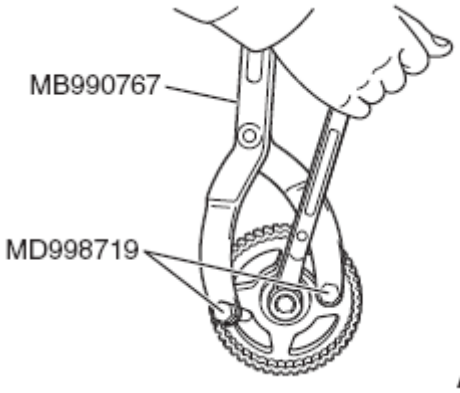


Fig. 46: Camshaft Sprocket & Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Clamp the hexagon 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)

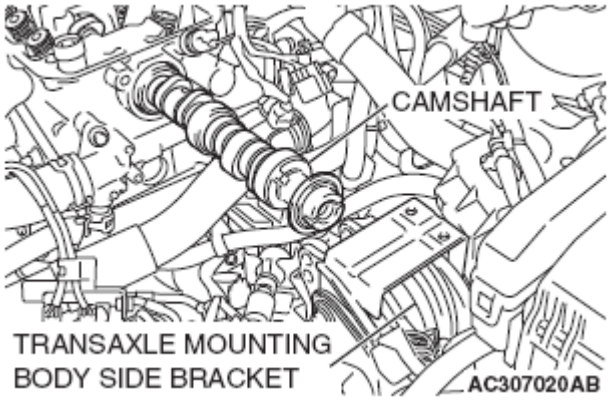


Fig. 47: Tightening Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

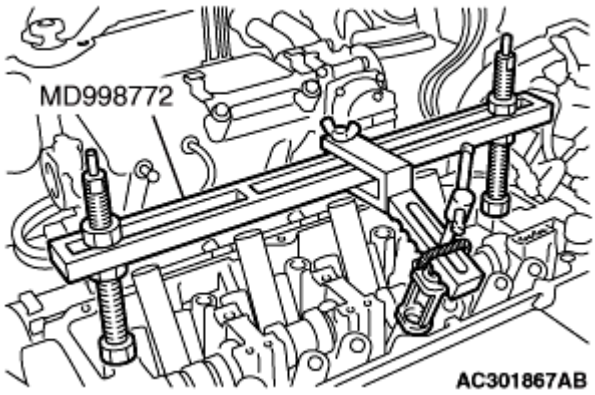


Fig. 48: Aligning Intake Side Paint Mark Of Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

NOTE: Because the thrust camshaft bearing cap and camshaft bearing cap are the same in shape, check the bearing cap number and additionally its

symbol to identify the intake and exhaust sides for correct installation.

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

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

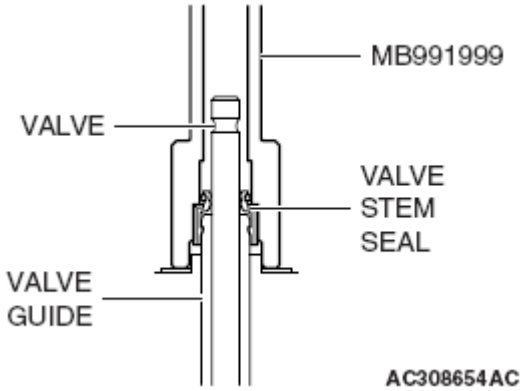


Fig. 49: Camshaft Bearing Cap Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

CAUTION: Be careful not to drop the camshaft bearing.

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 below.

FRONT CAMSHAFT BEARING CAP SPECIFICATION

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

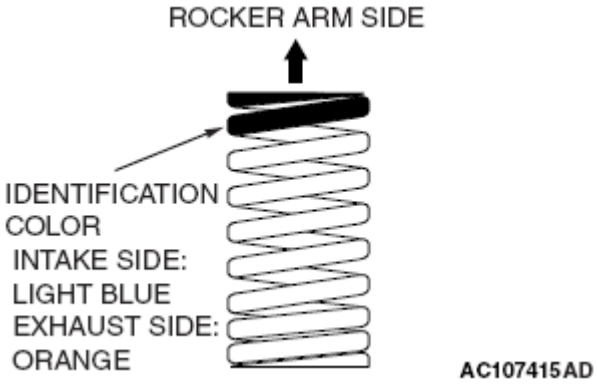


Fig. 50: Front Camshaft Bearing Cap
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

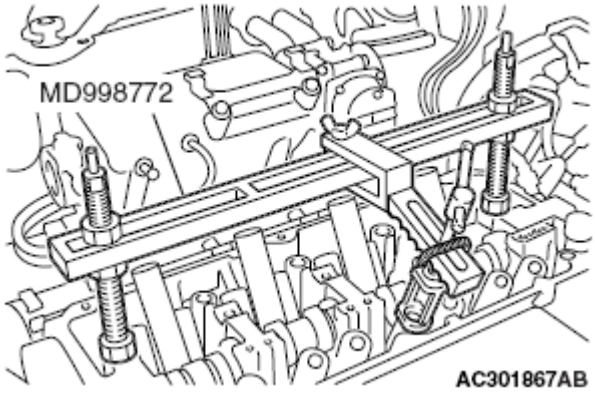


Fig. 51: Oil Hole & Notch
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

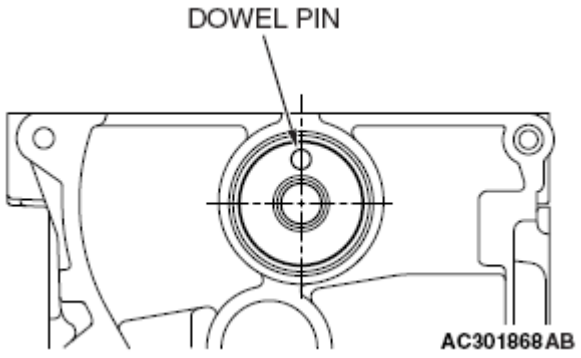


Fig. 52: Inserting Precision Flat-Tipped Screwdriver To Service Hole Of Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

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. 54**).

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.

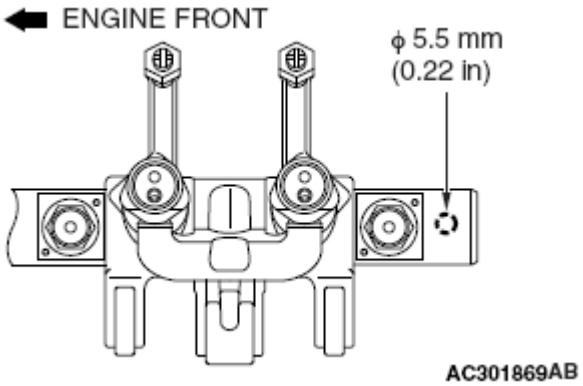


Fig. 53: Inserting Special Tool (MB992103) Tension Side Of Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. With the special tool MB992103 inserted up to the insertion guide line, press the special tool MB992103 against the intake side camshaft sprocket (**Fig. 54**) and spread and hold the timing chain tension side guide (**Fig. 54**).

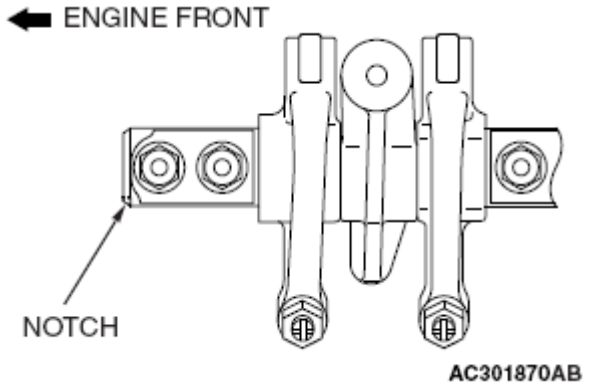


Fig. 54: Pulling Camshaft & Camshaft Sprocket Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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. 54**) to provide allowance for easy installation of the camshaft and camshaft sprocket assembly (exhaust side) to the timing chain.

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.

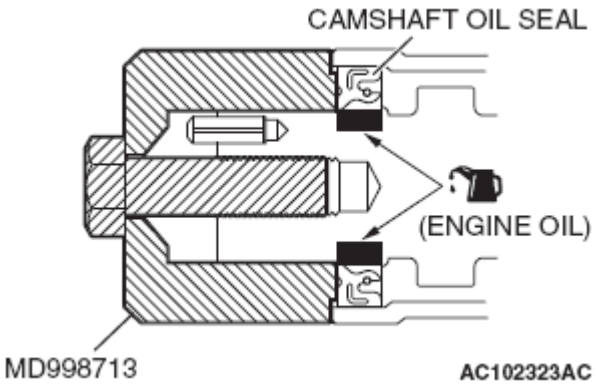


Fig. 55: Aligning Exhaust Side Paint Mark Of Timing Chain
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. Install the camshaft and camshaft sprocket assembly (exhaust side) to the cylinder head.
9. Remove the special tool inserted into the timing chain case assembly inside.

>>F<< FRONT CAMSHAFT BEARING CAP ASSEMBLY INSTALLATION

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

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

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

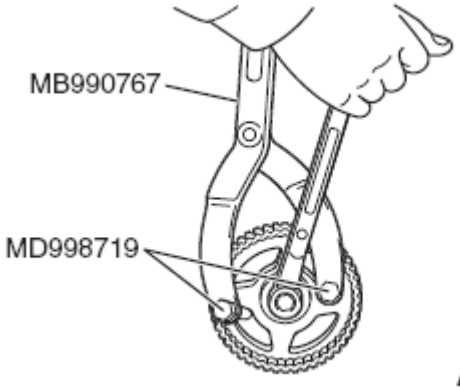


Fig. 56: Front Camshaft Bearing Cap Assembly Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

3. After installing the front camshaft bearing cap, check that the paint marks of camshaft sprocket and of timing chain, the timing mark of crankshaft pulley, and the T-mark position of ignition timing indicator are aligned correctly.

>>G<< ROCKER COVER ASSEMBLY INSTALLATION

1. Wipe off the sealant on the mating surface of the rocker cover assembly and the cylinder head and timing chain case assembly, and degrease the surface where the sealant is applied.

   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 below 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 the application of

sealant.

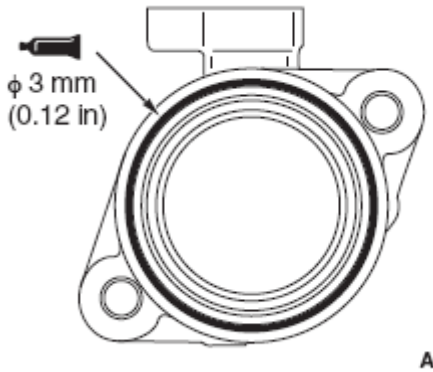


Fig. 57: Applying Sealant Between Cylinder Head & Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

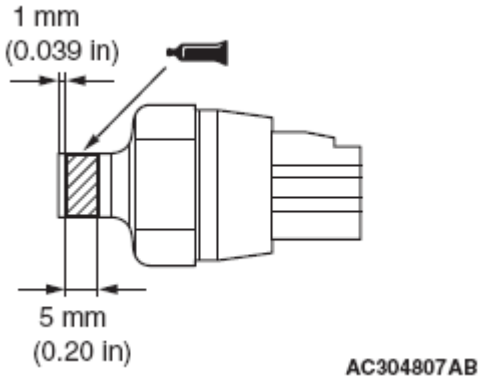


Fig. 58: Rocker Cover Assembly Mounting Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 above.

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

VALVE STEM SEAL

REMOVAL AND INSTALLATION

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

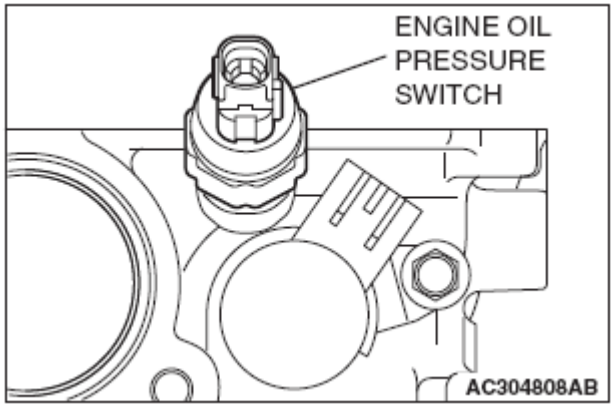


Fig. 59: Valve Stem Seal Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 ASSEMBLY REMOVAL

CAUTION: Be careful not to drop the camshaft bearing.

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

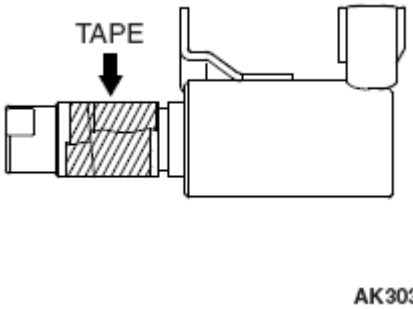


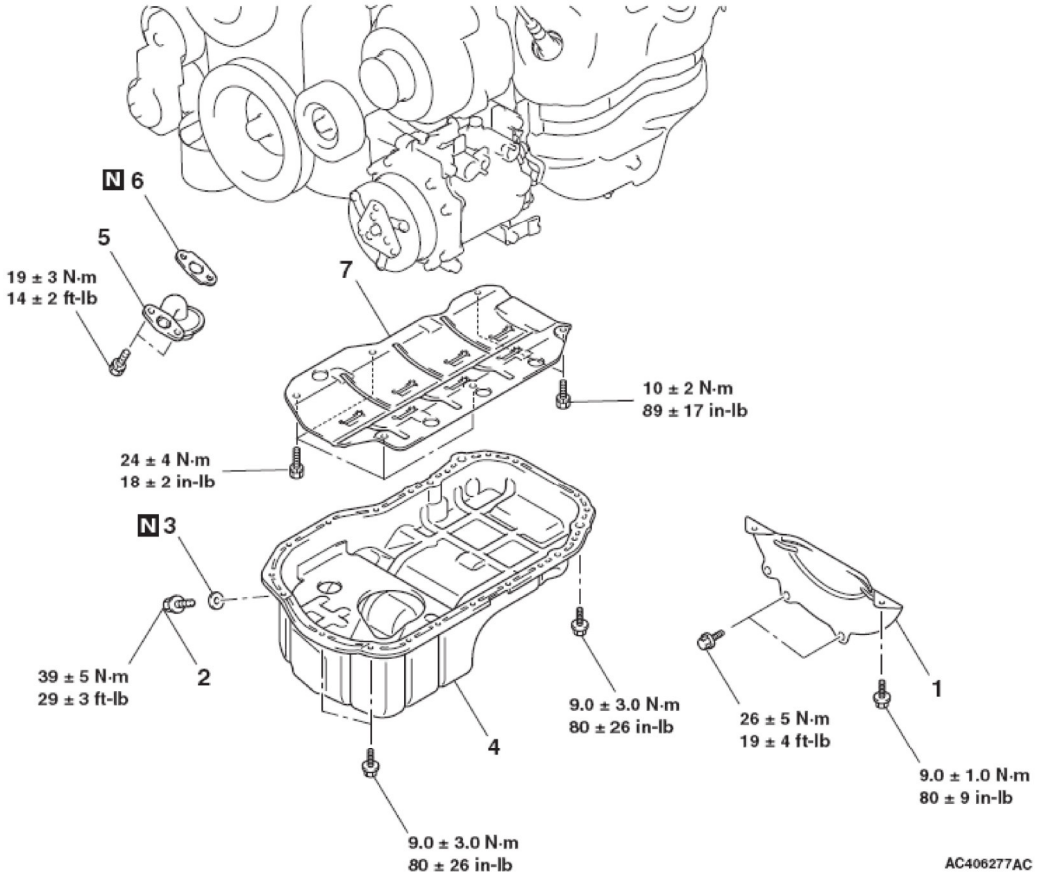
Fig. 60: Front Camshaft Bearing Cap Assembly Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal • Engine Oil Draining • Front No.1 Exhaust Pipe Removal • Front No.2 Exhaust Pipe Removal	• Front No.2 Exhaust Pipe Installation • Front No.1 Exhaust Pipe Installation • Engine Oil Refilling • Side Under Cover Installation



REMOVAL STEPS

1. TORQUE CONVERTER HOUSING FRONT LOWER COVER
2. ENGINE OIL PAN DRAIN PLUG
>>B<< 3. ENGINE OIL PAN DRAIN PLUG GASKET
<<A>> >>A<< 4. ENGINE OIL PAN
5. ENGINE OIL PAN STRAINER
6. ENGINE OIL PAN STRAINER GASKET
7. BAFFLE PLATE

Fig. 61: Camshaft Bearing Cap 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.

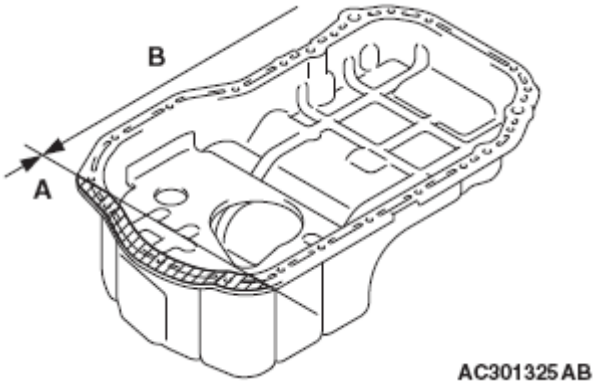


Fig. 62: Removing/Installing Valve Tappets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<D>> VALVE SPRING RETAINER LOCK REMOVAL

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

CAUTION: When removing the valve spring retainer lock, leave the piston of the cylinder in the TDC (Top Dead Center) position. The valve may fall into the cylinder if the piston is not properly in the TDC position.

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

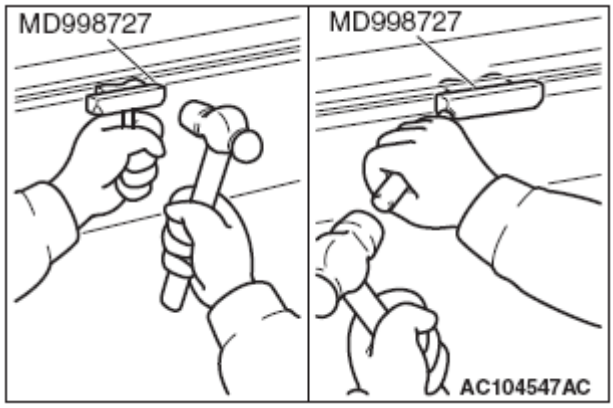


Fig. 63: Compressing Valve Spring
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<E>> VALVE STEM SEAL REMOVAL

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

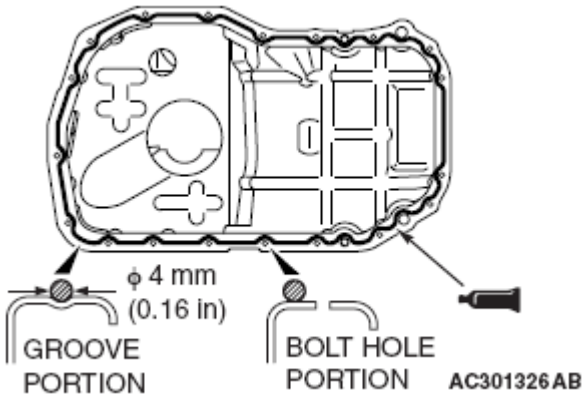


Fig. 64: Removing Valve Stem Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< VALVE STEM SEAL INSTALLATION

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

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

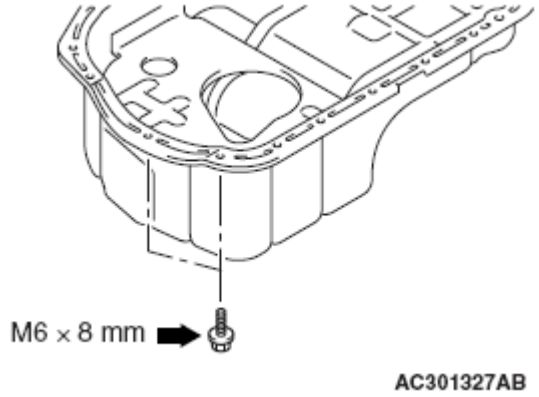


Fig. 65: Valve Stem Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

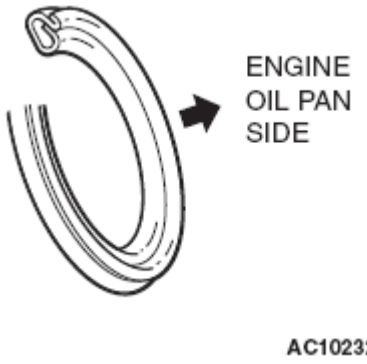
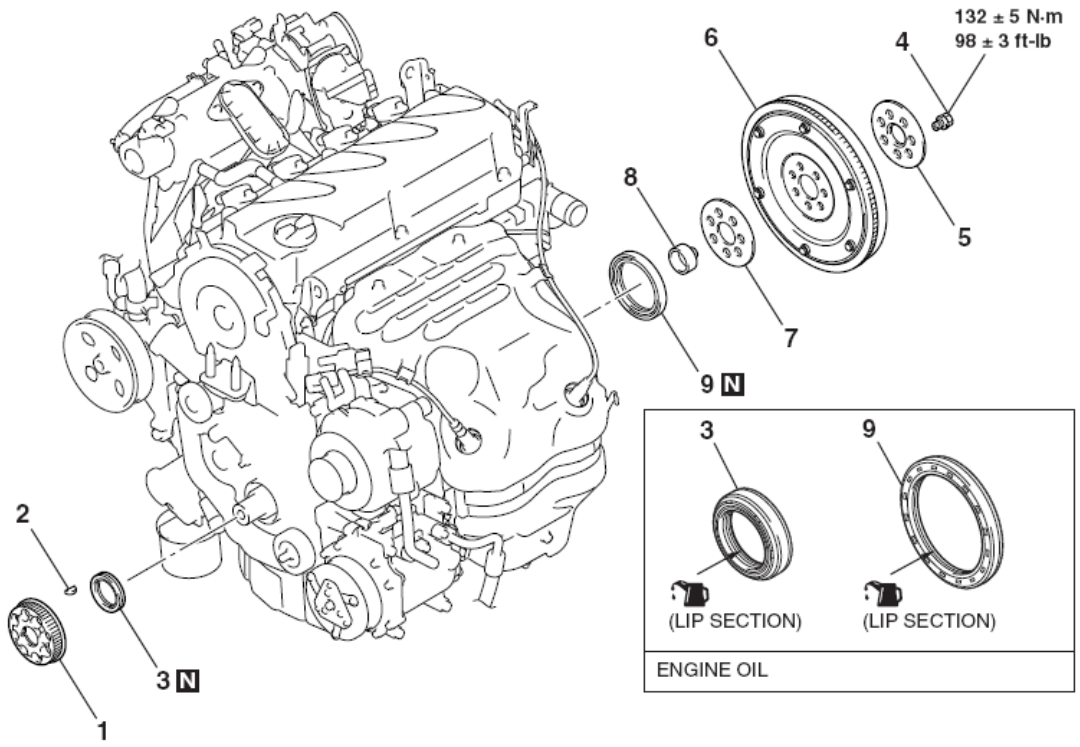


Fig. 66: Valve Stem Seal, Valve Guide & Valve Stem
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< VALVE SPRING INSTALLATION

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



CRANKSHAFT FRONT OIL SEAL REMOVAL STEPS

- VALVE TIMING BELT AND BALANCER TIMING BELT <<A>>
- >>D<< 1. CRANKSHAFT BALANCER SHAFT DRIVE SPROCKET <<B>>
- 2. CRANKSHAFT KEY
- >>C<< 3. CRANKSHAFT FRONT OIL SEAL

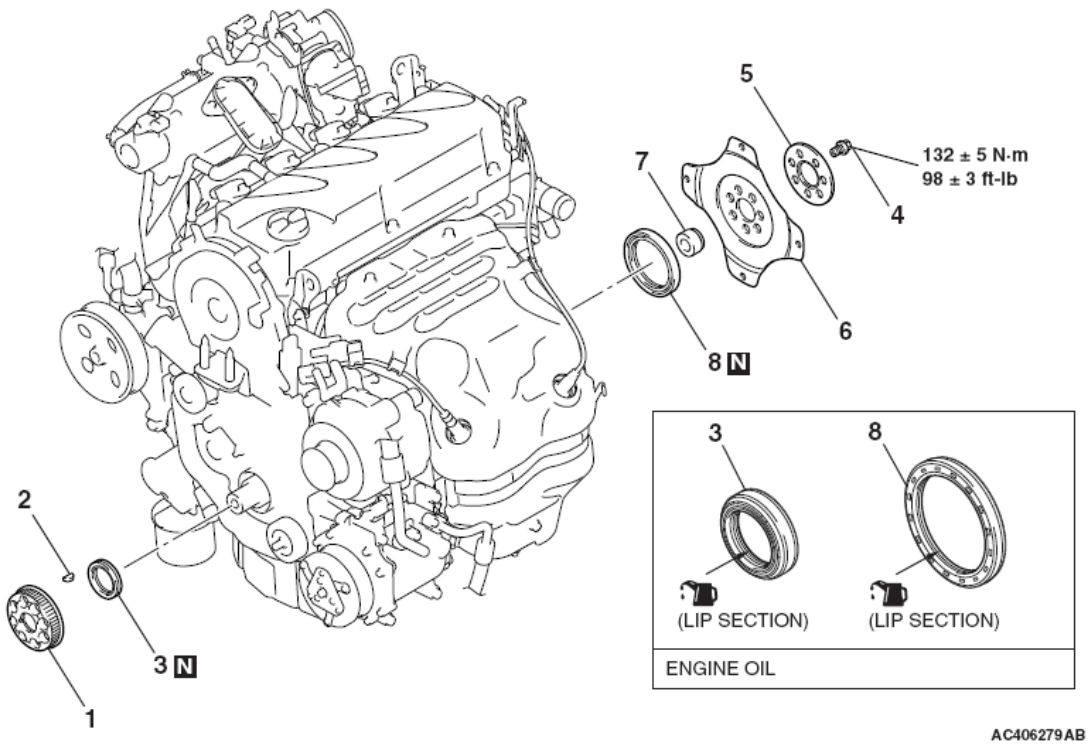
CRANKSHAFT REAR OIL SEAL REMOVAL STEPS

- TRANSAXLE ASSEMBLY
- CLUTCH COVER AND CLUTCH DISC
- >>B<< 4. FLYWHEEL BOLTS
- 5. FLYWHEEL ADAPTER PLATE
- 6. FLYWHEEL ASSEMBLY
- 7. FLYWHEEL ADAPTER PLATE
- 8. CRANKSHAFT BUSHING
- >>A<< 9. CRANKSHAFT REAR OIL SEAL

Fig. 67: Valve Spring
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 tool MB992090 and special tool MB992089 attached to compress the valve spring, and install the valve spring retainer lock.



CRANKSHAFT FRONT OIL SEAL REMOVAL STEPS

- VALVE TIMING BELT AND BALANCER TIMING BELT

>>D<< 1. CRANKSHAFT BALANCER SHAFT DRIVE SPROCKET
2. CRANKSHAFT KEY
>>C<< 3. CRANKSHAFT FRONT OIL SEAL

<<B>>

CRANKSHAFT REAR OIL SEAL REMOVAL STEPS

- TRANSAXLE ASSEMBLY

>>B<< 4. A/T DRIVE PLATE BOLTS
5. A/T DRIVE PLATE ADAPTER PLATE
6. A/T DRIVE PLATE
7. CRANKSHAFT BUSHING
>>A<< 8. CRANKSHAFT REAR OIL SEAL

Fig. 68: Compressing Valve Spring
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< VALVE TAPPET INSTALLATION

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

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

2. Install the valve tappet to the cylinder head.

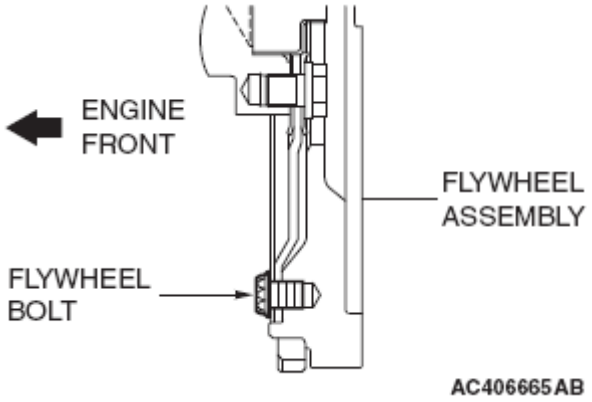


Fig. 69: Removing/Installing Valve Tappets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

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

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

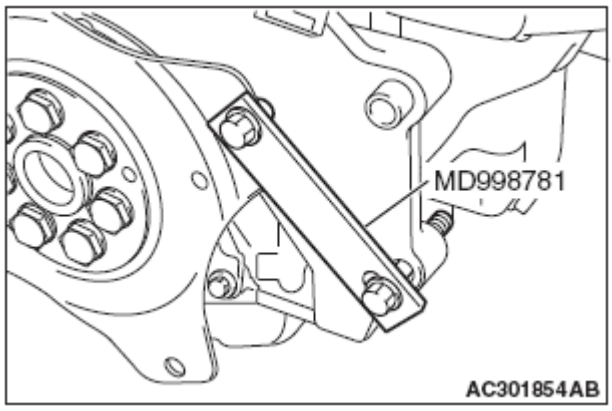


Fig. 70: Camshaft Bearing Cap Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 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 below.

FRONT CAMSHAFT BEARING CAP SPECIFICATION

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

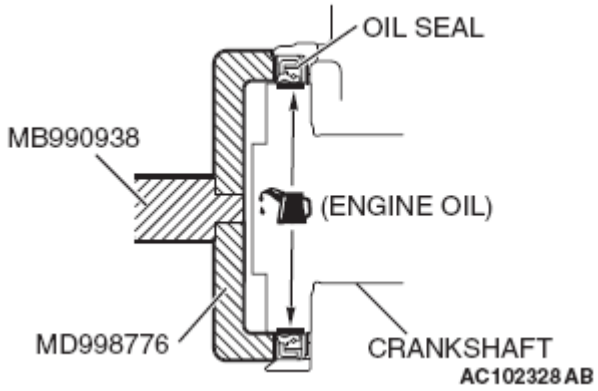


Fig. 71: Front Camshaft Bearing Cap
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

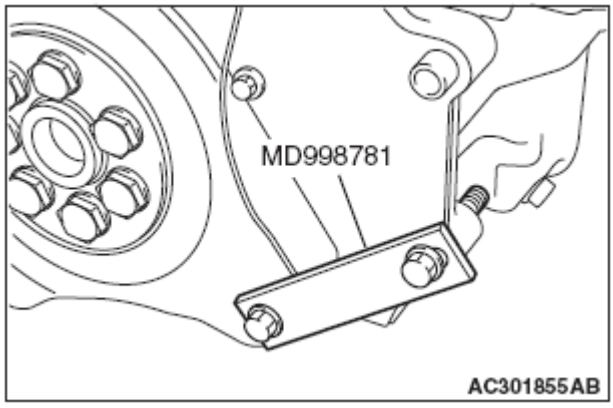


Fig. 72: Oil Hole & Notch
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>G<< FRONT CAMSHAFT BEARING CAP ASSEMBLY INSTALLATION

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

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

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

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

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

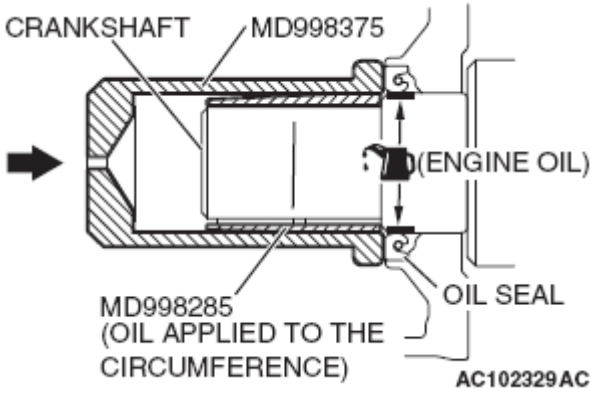


Fig. 73: Front Camshaft Bearing Cap Assembly Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

OIL PAN

REMOVAL AND INSTALLATION

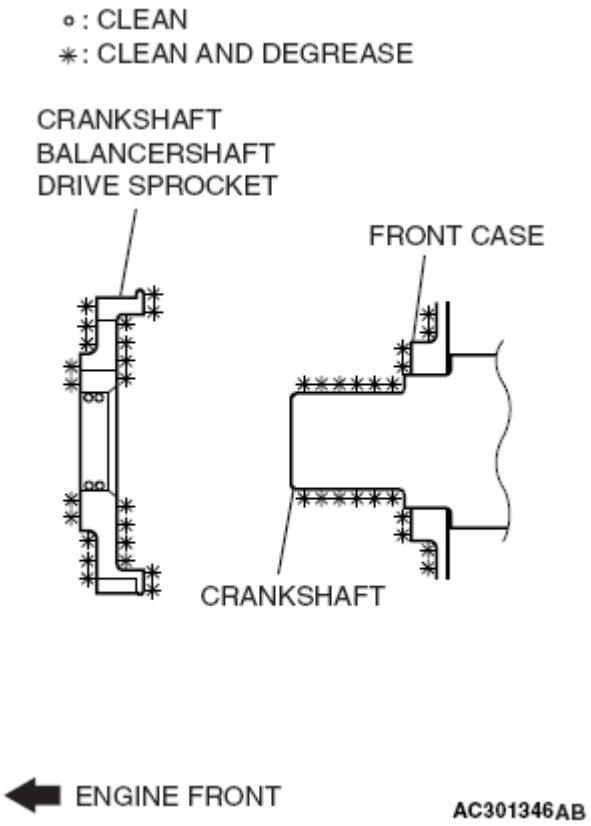


Fig. 74: Oil Pan Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

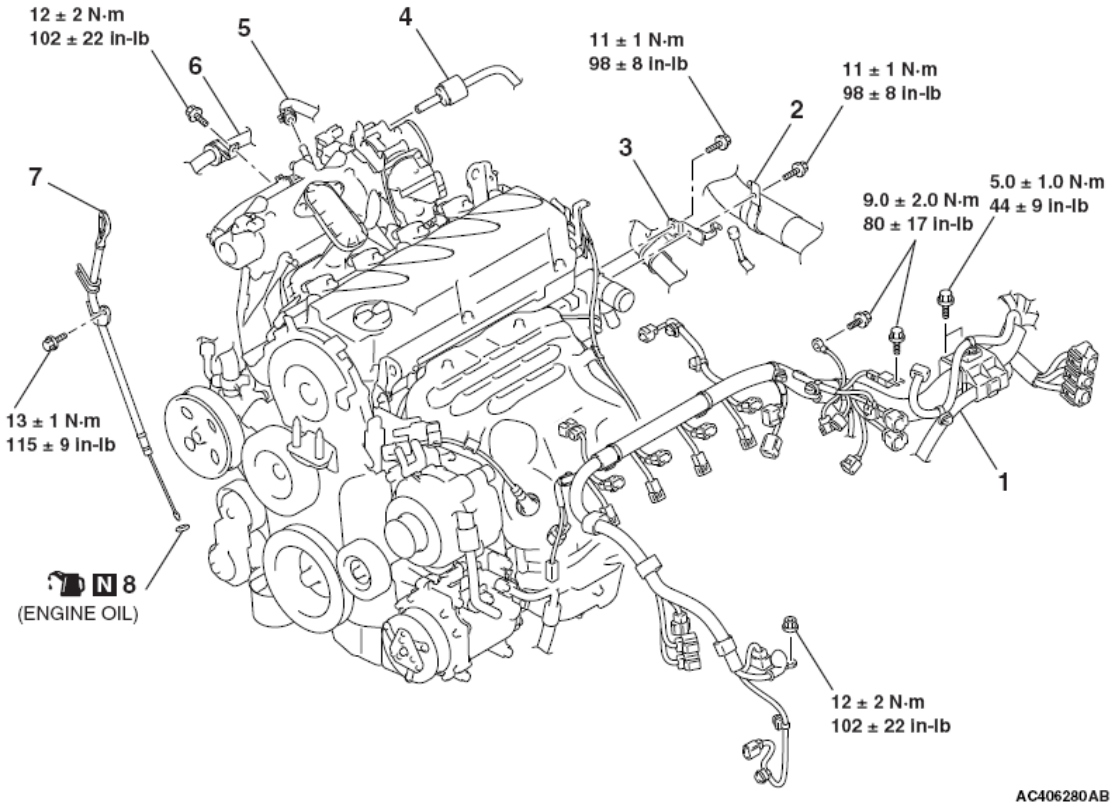
1. Remove the engine oil pan mounting bolts.

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 from the engine oil pan removal groove of the cylinder block assembly.

3. Lightly tap the special tool with a hammer to slide the oil pan seal surface, cut off the liquid gasket, and remove the engine oil pan.

Pre-removal Operation	Post-installation Operation
• Fuel Line Pressure Reduction • Engine Coolant Draining • ECM <M/T> or PCM <A/T> Removal • Air Cleaner Removal • Battery and Battery Tray Removal	• Battery and Battery Tray Installation • Air Cleaner Installation • ECM <M/T> or PCM <A/T> Installation • Engine Coolant Refilling • Fuel Leak Check

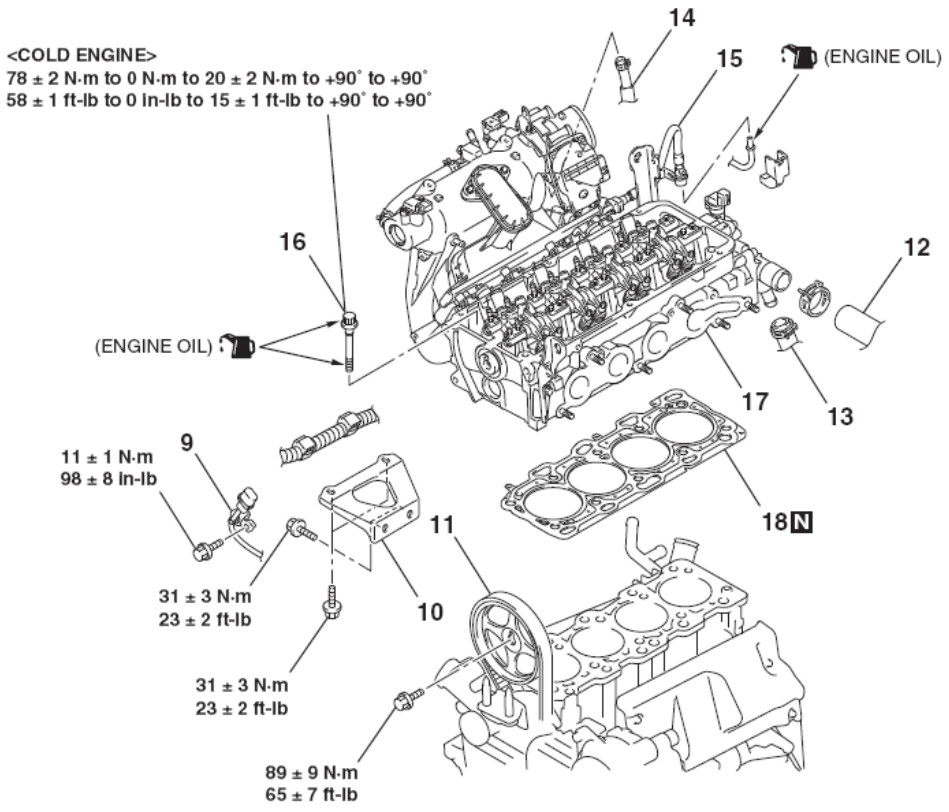


REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. RADIATOR LOWER HOSE CLAMP
3. WATER HOSE CLAMP <A/T>
4. EVAPORATIVE EMISSION PURGE HOSE CONNECTION

>>F<< 5. BRAKE BOOSTER VACUUM HOSE CONNECTION
6. PRESSURE HOSE CLAMP
7. ENGINE OIL DIPSTICK AND DIPSTICK GUIDE
8. O-RING

Fig. 75: Engine Oil Pan & Crankshaft Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



REMOVAL STEPS

9. KNOCK SENSOR CONNECTOR CONNECTION
10. INTAKE MANIFOLD STAY
    - EXHAUST MANIFOLD
    - TIMING BELT UPPER COVER
    - ENGINE FRONT MOUNTING BRACKET
11. CAMSHAFT SPROCKET <<A>> >>E<<
12. RADIATOR UPPER HOSE CONNECTION <<B>> >>D<<
13. WATER COOLER HOSE CONNECTION <A/T>
14. WATER HOSE CONNECTION
    - WATER INLET FITTING AND THERMOSTAT CASE ASSEMBLY
15. FUEL HIGH-PRESSURE HOSE CONNECTION <<C>> >>C<<
    - ROCKER COVER ASSEMBLY
16. CYLINDER HEAD BOLTS <<D>> >>B<<
17. CYLINDER HEAD ASSEMBLY
18. CYLINDER HEAD GASKET >>A<<

Fig. 76: Engine Oil Pan & Engine Oil Filter
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

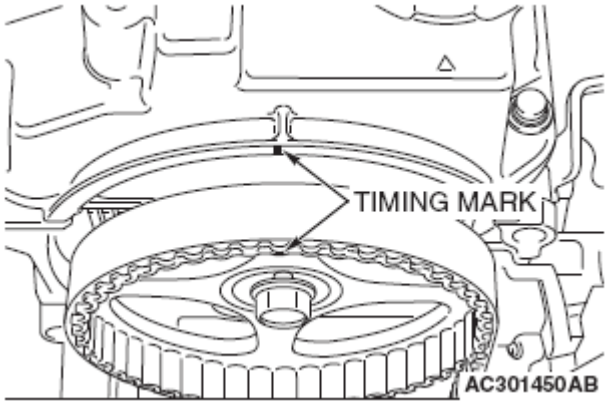


Fig. 77: Tapping Oil Pan FIPG Cutter With Hammer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 below, and install the engine oil pan to the cylinder block assembly.

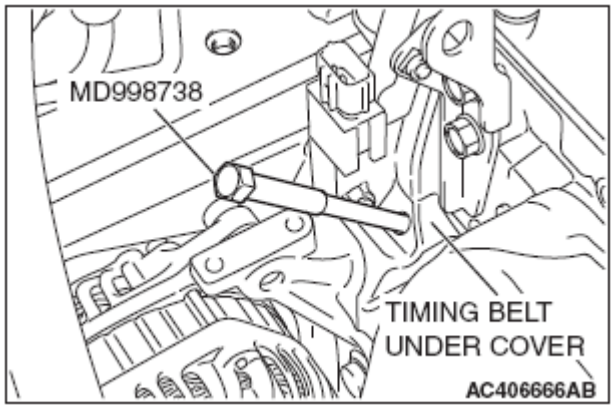


Fig. 78: Oil Pan Sealant Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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)

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

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

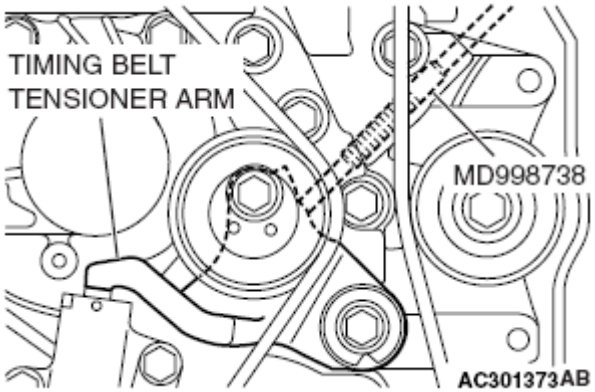


Fig. 79: Engine Oil Pan Drain Plug Gasket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 below.

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

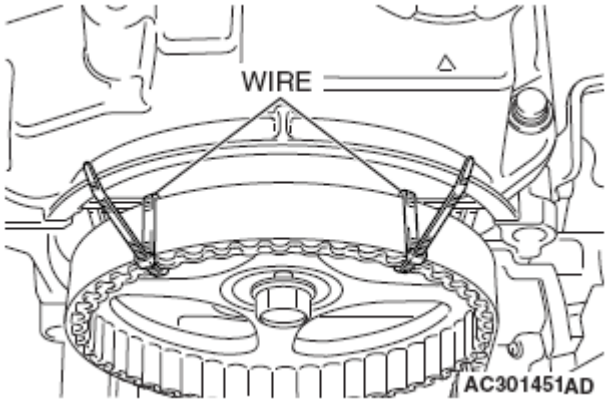


Fig. 80: A/C Compressor & Clutch Assembly Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

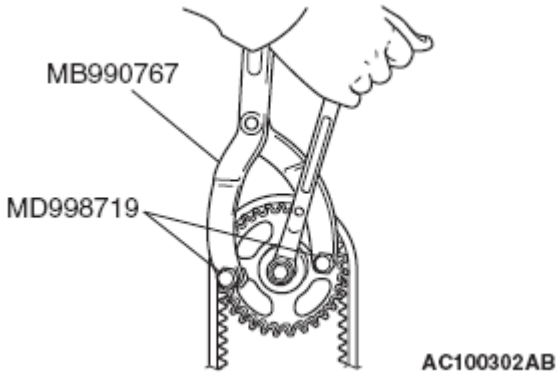


Fig. 81: Crankshaft Oil Seal Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

REMOVAL SERVICE POINT

<<A>> FLYWHEEL BOLTS REMOVAL

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

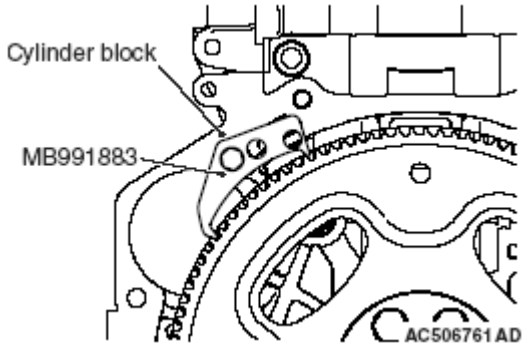


Fig. 82: Fixing Flywheel Or Drive Plate
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 below, and install the crankshaft rear oil seal case assembly.

   Specified sealant: Three bond 1227D or equivalent

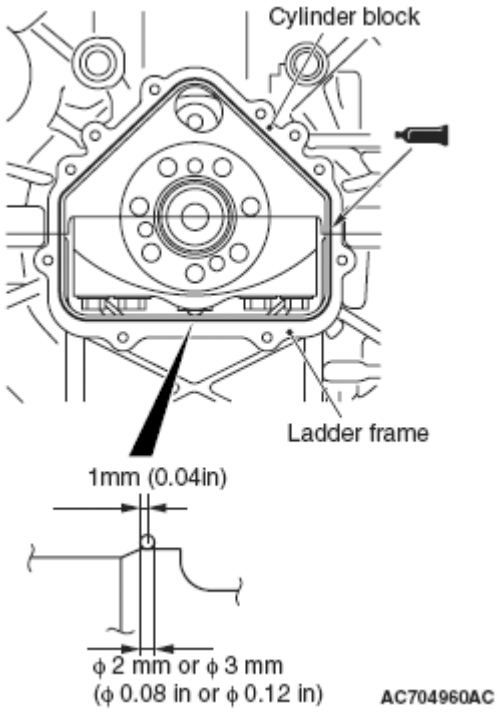


Fig. 83: Crankshaft Rear Oil Seal Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 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 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)

>>B<< FLYWHEEL/FLYWHEEL HUB <TC-SST>/FLYWHEEL BOLTS INSTALLATION

1. Remove the engine oil and deposits from the flywheel bolt threads, crankshaft tapped hole, and flywheel.
2. Install the flywheel and flywheel hub <TC-SST> to the crankshaft.
3. Use special tool MB991883 to secure the flywheel assembly in the same manner as removal.

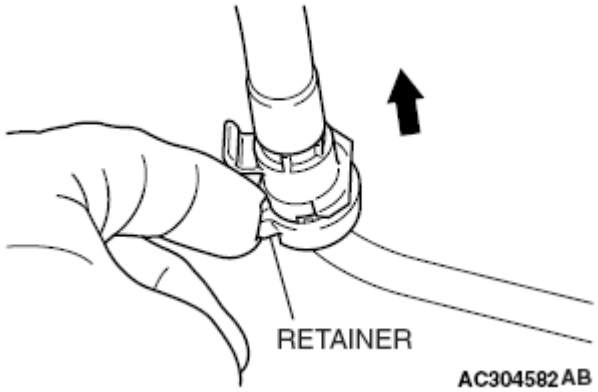


Fig. 84: Fixing Flywheel Or Drive Plate
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Apply a small amount of engine oil to the bearing surfaces of flywheel bolts and crankshaft tapped hole, and apply the sealant to the bolt threads of flywheel.

Specified sealant: Three bond 1324 or exact equivalent

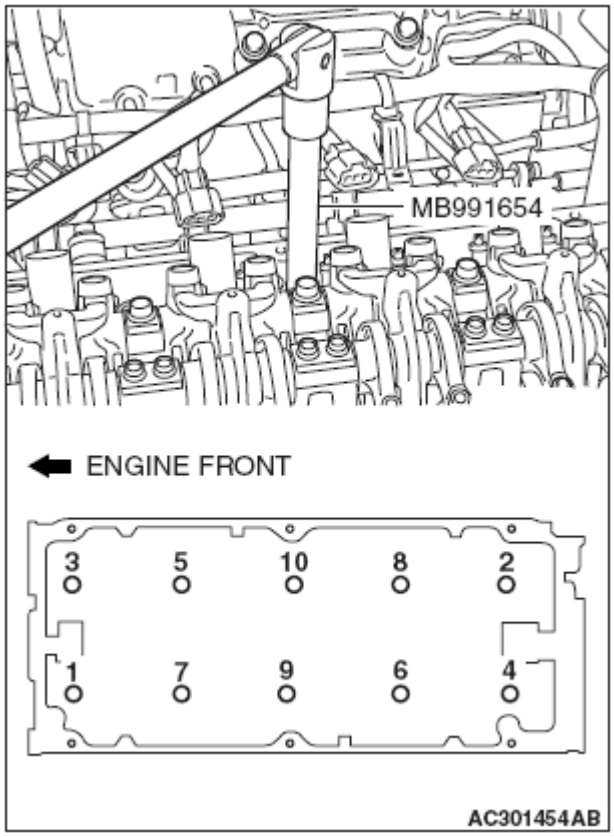


Fig. 85: Applying Sealant To Thread Of Flywheel Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Tighten flywheel bolts to temporary torque 40 N.m (30 ft-lb) in the order shown in the illustration below.
6. Tighten flywheel bolts to specified torque in the order shown in the illustration below.

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

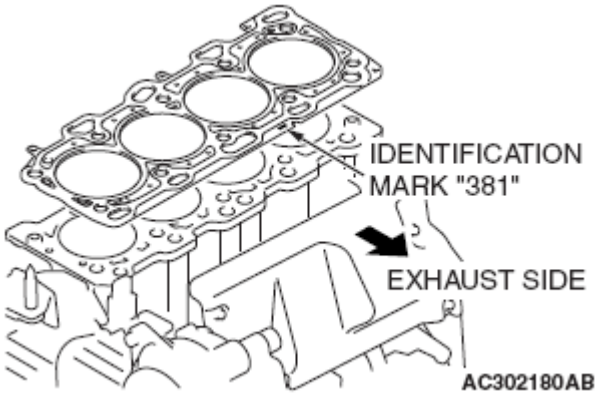


Fig. 86: Flywheel Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

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

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

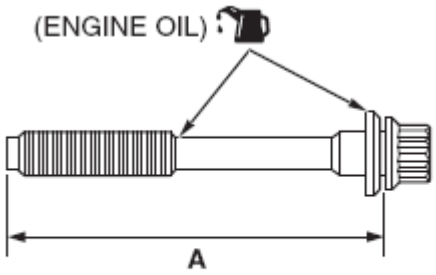


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Fig. 87: Pressing Crankshaft Front Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

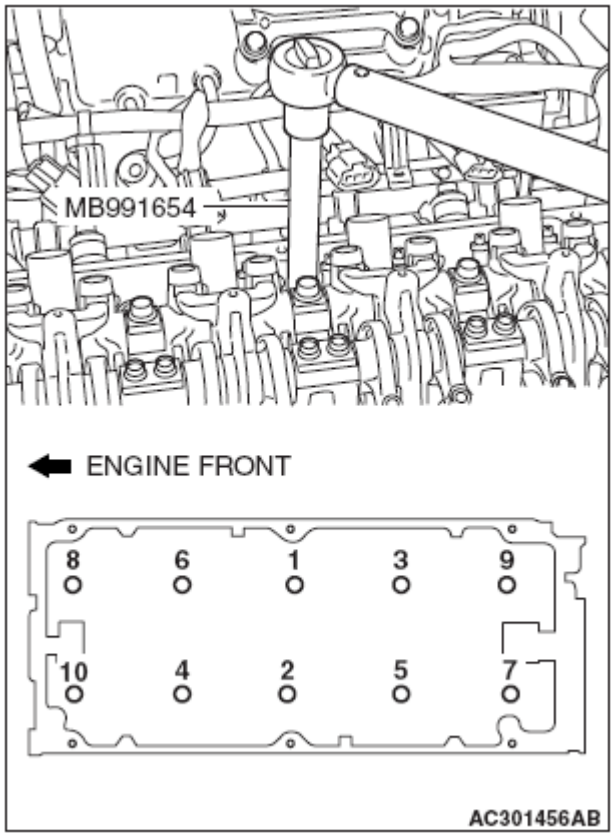


Fig. 88: Cylinder Head Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

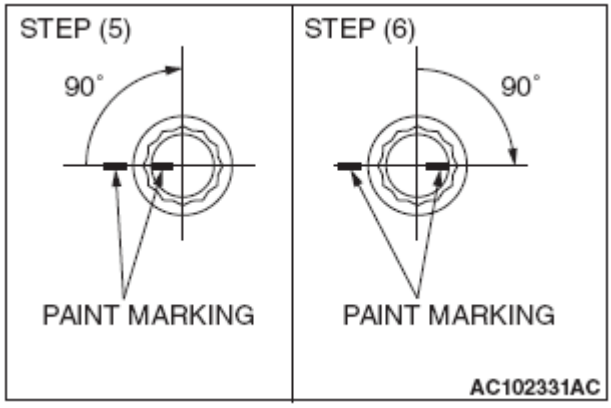


Fig. 89: Cylinder Head Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 in illustration below to install them in the original position. Then, remove them.

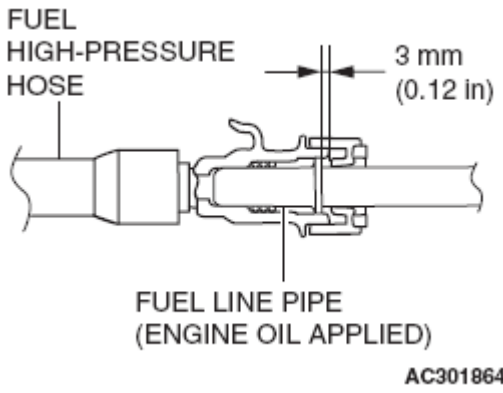


Fig. 90: Mating Marks On Radiator Hose & Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> FUEL HIGH-PRESSURE HOSE DISCONNECTION

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

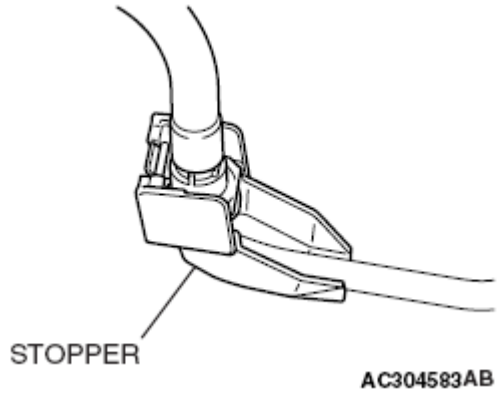


Fig. 91: Fuel High-Pressure Hose & Retainer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

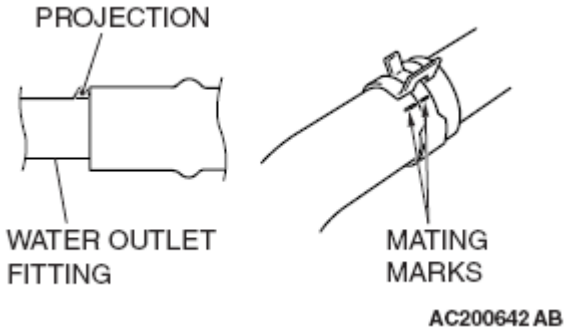


Fig. 92: Inserting Flat-Tipped Screwdriver Into Retainer Of Fuel High-Pressure Hose Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

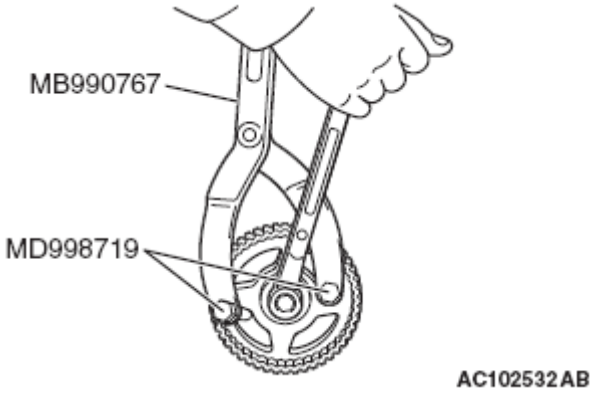


Fig. 93: Removing Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the fuel high-pressure hose.

<<C>> FRONT CAMSHAFT BEARING CAP ASSEMBLY REMOVAL

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

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

2. Place a garage jack against the engine oil pan with a piece of wood in between to support the engine and

transaxle assembly.

3. Remove special tool MB991928 or MB991895 which was installed for supporting the engine and transaxle assembly when the valve timing chain was removed.

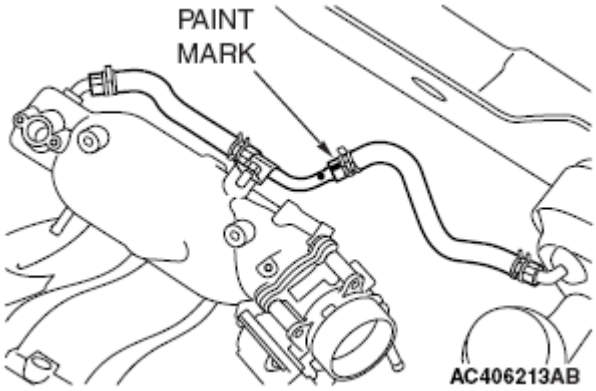
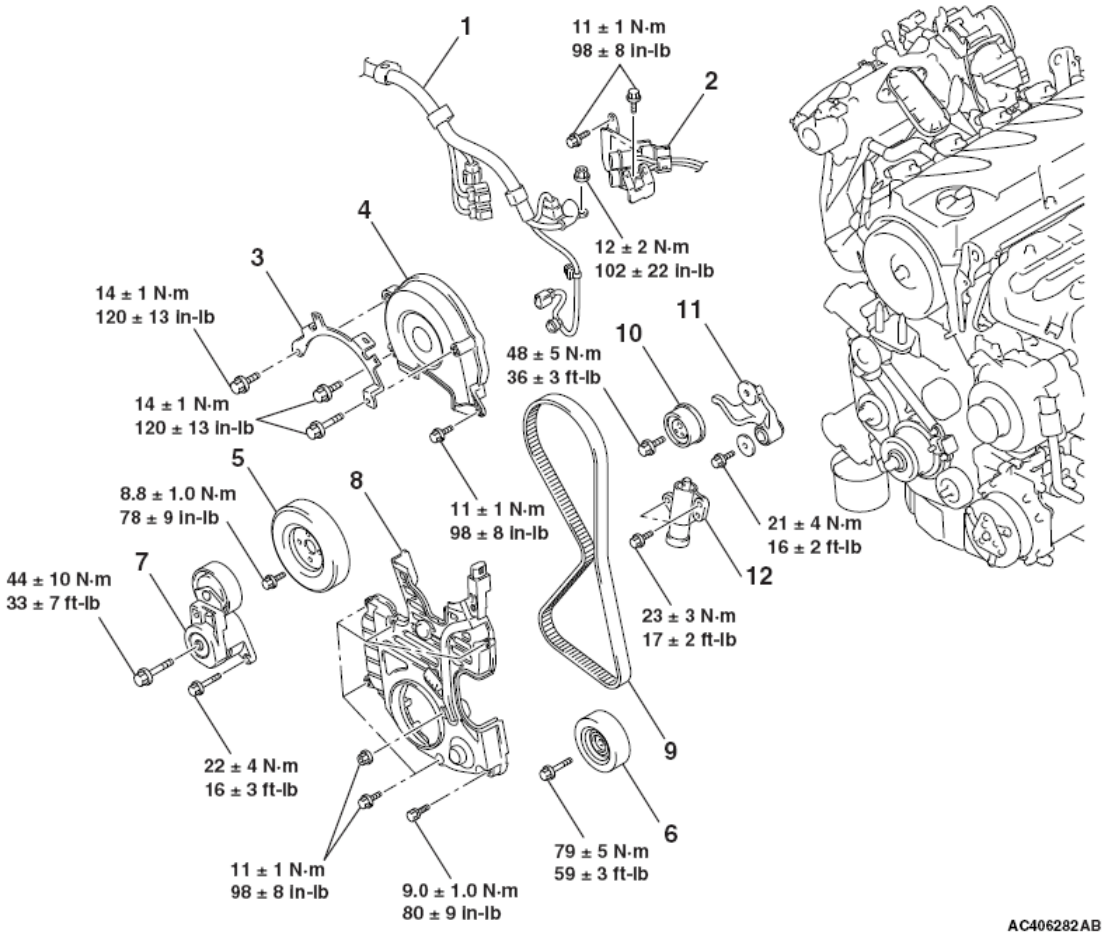


Fig. 94: Supporting Engine & Transaxle Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal • Crankshaft Shaft Damper Pulley Removal	• Crankshaft Shaft Damper Pulley Installation • Drive Belt Tension Check • Side Under Cover Installation



REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. CONNECTOR BRACKET
3. HARNESS BRACKET
4. TIMING BELT UPPER COVER
   - ENGINE FRONT MOUNTING BRACKET
5. WATER PUMP PULLEY
6. IDLER PULLEY
7. AUTO-TENSIONER
8. TIMING BELT LOWER COVER

>>G<<
- VALVE TIMING BELT TENSION ADJUSTMENT (INSTALLATION ONLY)

<<A>> >>F<<
9. VALVE TIMING BELT

>>E<<
10. TIMING BELT TENSIONER PULLEY
11. TIMING BELT TENSIONER ARM

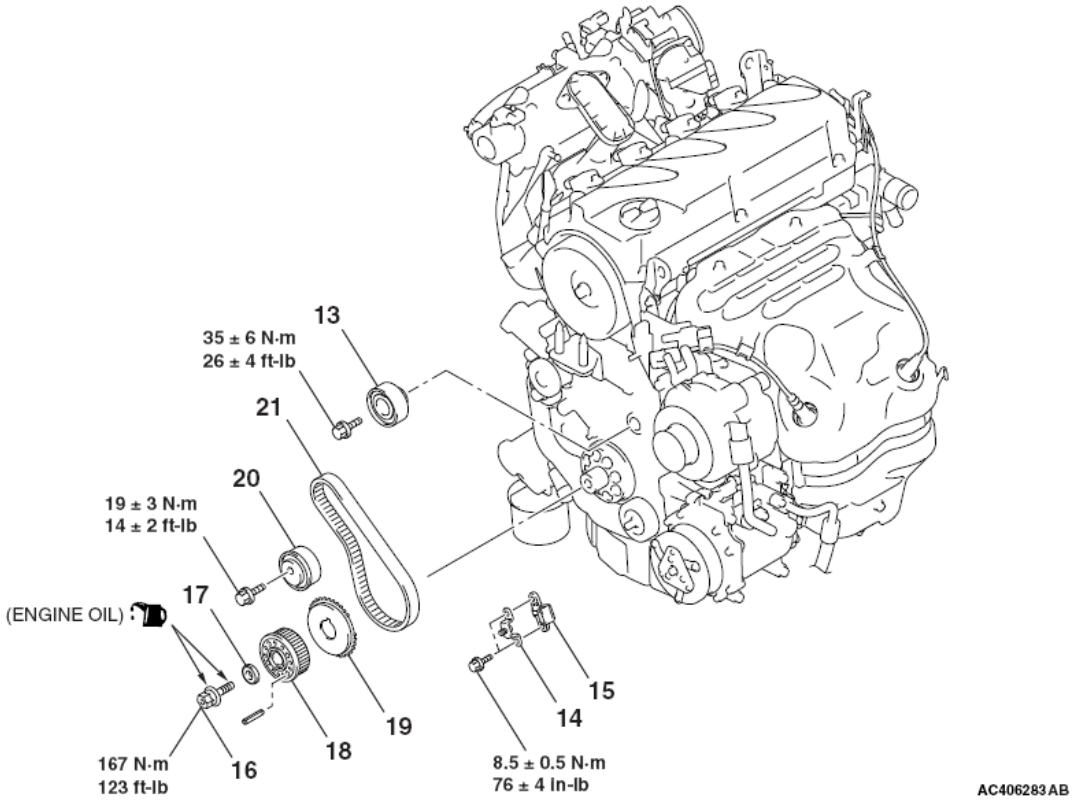
>>D<<
12. TIMING BELT TENSIONER ADJUSTER

Fig. 95: Supporting Transaxle Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Be careful not to drop the camshaft bearing.

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

below, and remove the front camshaft bearing cap assembly.



REMOVAL STEPS

- 13. TIMING BELT IDLER PULLEY
- 14. TIMING BELT LOWER COVER BRACKET
- 15. CRANKSHAFT POSITION SENSOR
- <<B>> >>C<< 16. CRANKSHAFT PULLEY CENTER BOLT
- <<B>> >>C<< 17. CRANKSHAFT PULLEY WASHER
- <<B>> >>C<< 18. CRANKSHAFT CAMSHAFT DRIVE SPROCKET
- >>C<< 19. CRANKSHAFT ANGLE SENSING BLADE
- >>B<< • BALANCER TIMING BELT TENSION ADJUSTMENT (INSTALLATION ONLY)
- >>A<< 20. BALANCER TIMING BELT TENSIONER
- <<C>> >>A<< 21. BALANCER TIMING BELT

Fig. 96: Front Camshaft Bearing Cap Assembly 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 mounting bolts of the camshaft bearing caps in the order of number shown in the illustration below in four or five steps, and remove the camshaft bearing caps.

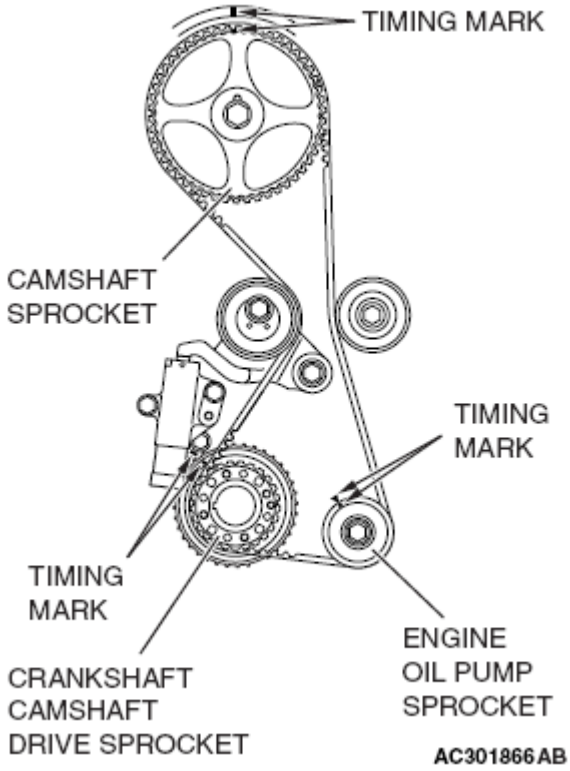


Fig. 97: Camshaft Bearing Cap Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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 below.

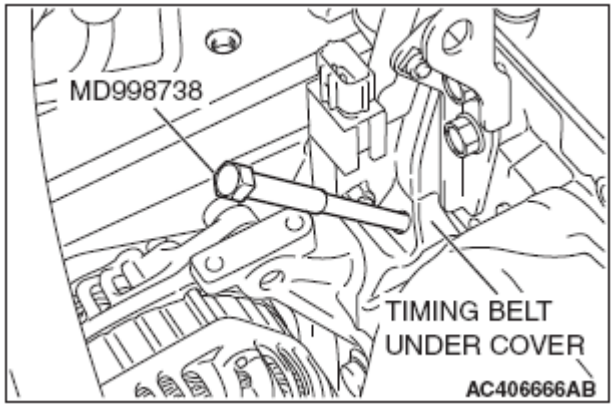


Fig. 98: Cylinder Head Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

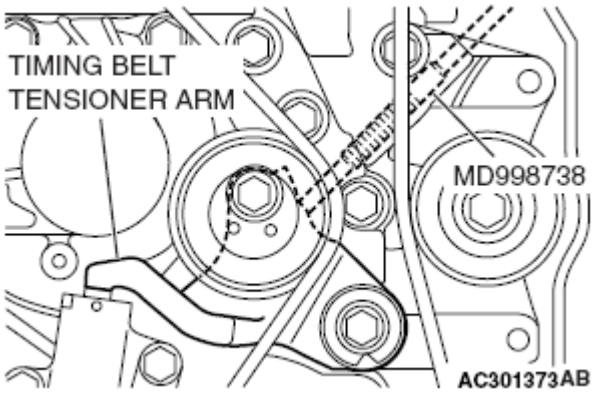


Fig. 99: Identifying Degrease Areas
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Specified sealant: Three bond 1217G or equivalent

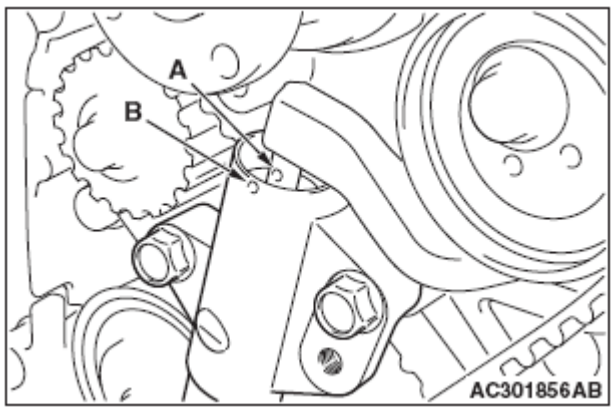


Fig. 100: Applying Sealant To Top Surface Of Cylinder Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

   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.

>>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 bolts of the timing chain side, the washer can be removed from the bolt. Install the washer, with its sag facing upward, to the bolts.
3. Apply a small amount of engine oil to the thread of the bolts and to the washers.
4. Tighten the bolts by the following procedure (plastic region angular tightening method).
   1. Tighten the bolts to 35 ± 2 N.m (26 ± 1 ft-lb) in the order of number shown in the illustration below.

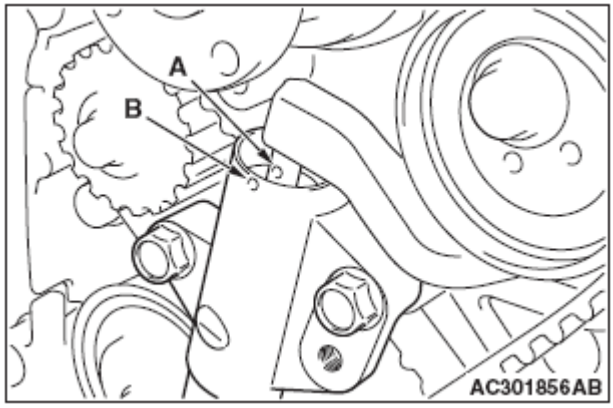


Fig. 101: Cylinder Head Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 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 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.

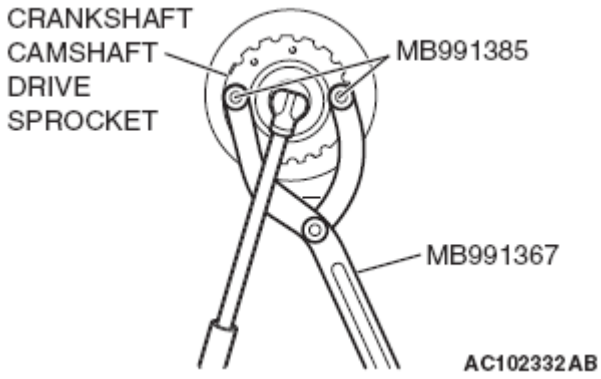


Fig. 102: Applying Paint Marks Of Cylinder Head Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 below.

FRONT CAMSHAFT BEARING CAP SPECIFICATION

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

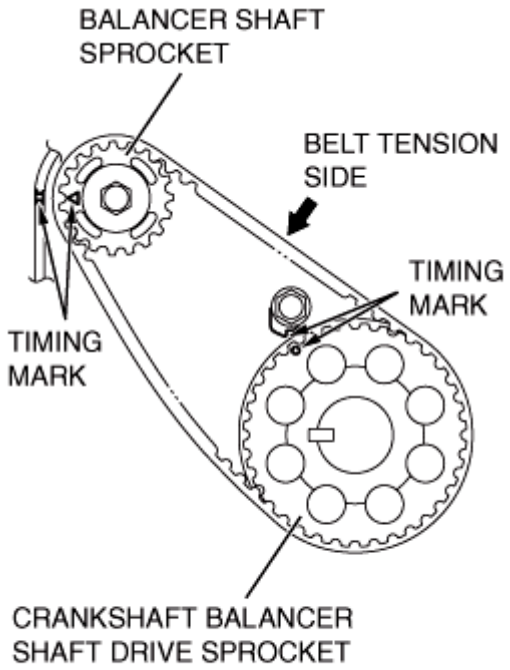


Fig. 103: Front Camshaft Bearing Cap & Identification Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

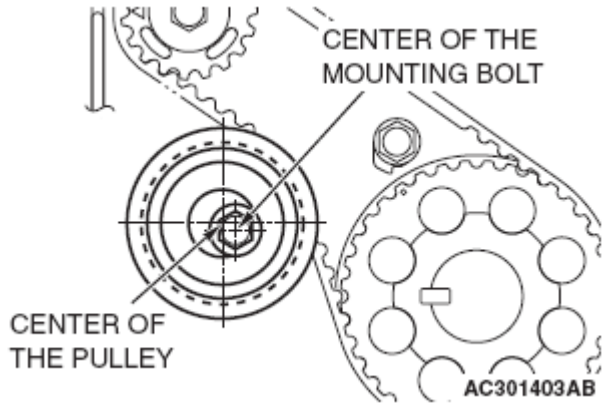


Fig. 104: Oil Hole & Notch
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

NOTE: Because the thrust camshaft bearing cap and camshaft bearing cap are the same in shape, check the bearing cap number and additionally its

symbol to identify the intake and exhaust sides for correct installation.

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

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

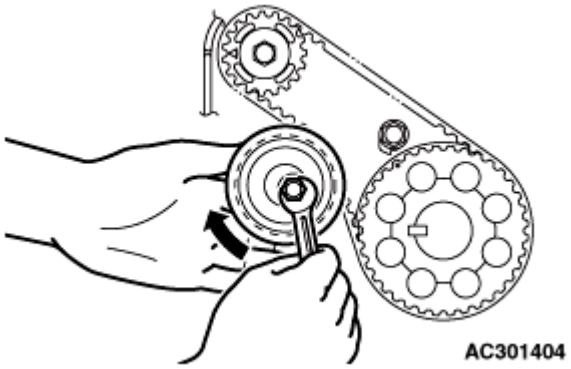


Fig. 105: Camshaft Bearing Cap Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< FRONT CAMSHAFT BEARING CAP ASSEMBLY INSTALLATION

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

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

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

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

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

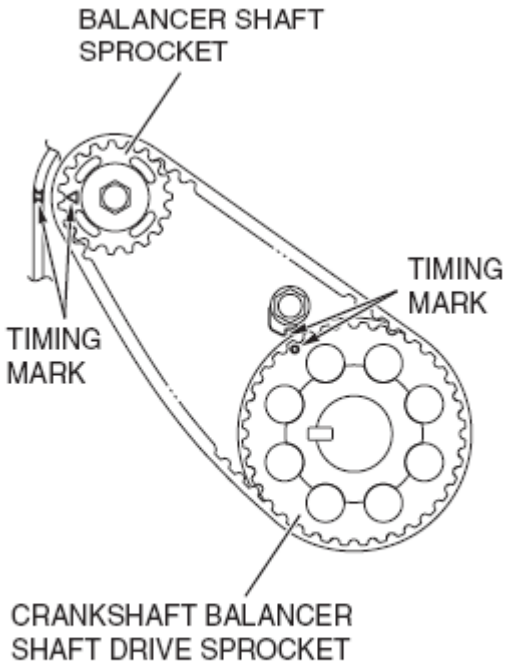


Fig. 106: Front Camshaft Bearing Cap Assembly Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 **<<D>> AUTO-TENSIONER REMOVAL**).
4. Remove the garage jack which supports the engine and transaxle assembly.
5. Remove the engine oil pan installed temporarily.

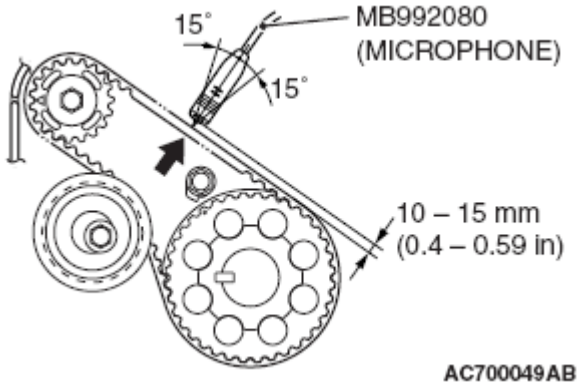


Fig. 107: Supporting Engine & Transaxle Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

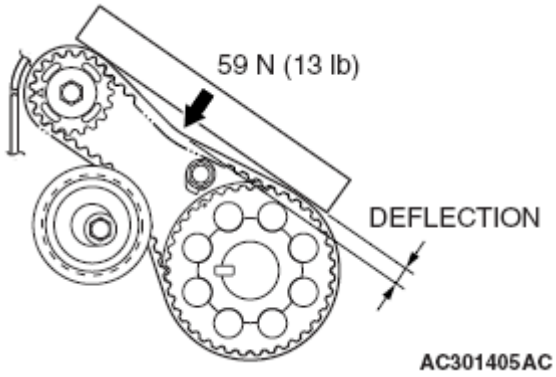


Fig. 108: Supporting Transaxle Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

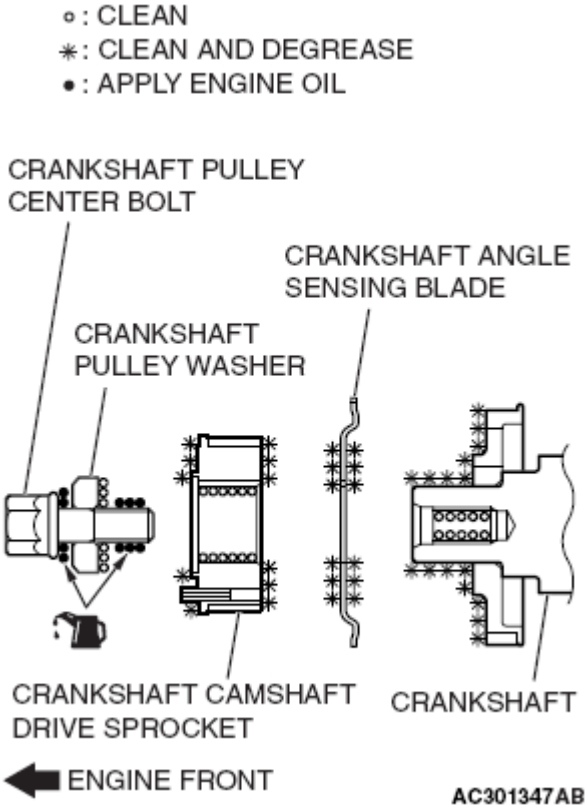


Fig. 109: O-Ring & Water Pump Inlet Pipe

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.

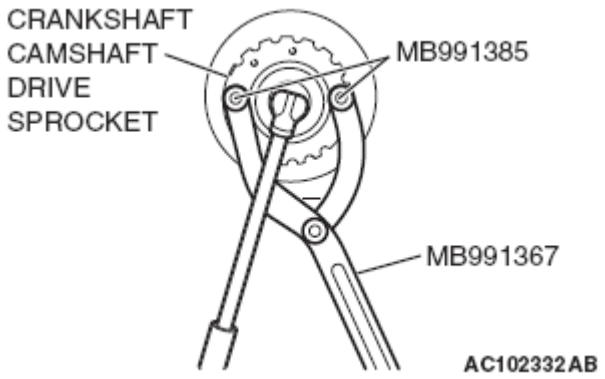


Fig. 110: Retainer, Stopper & Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

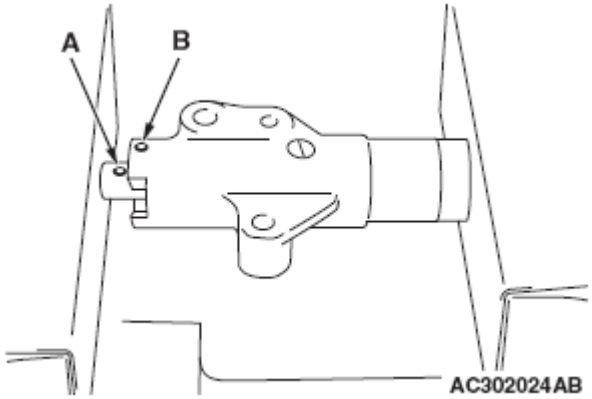


Fig. 111: Aligning Mating Marks On Radiator Hose & Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING CHAIN

REMOVAL AND INSTALLATION

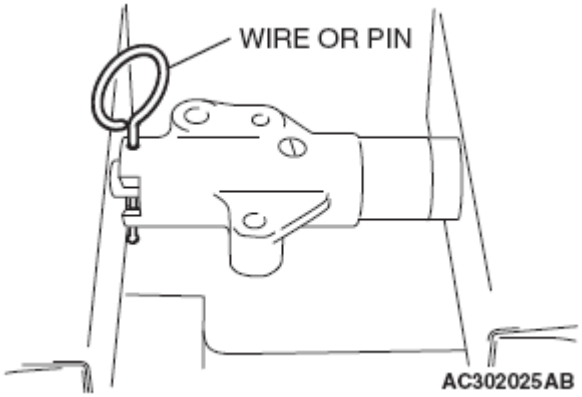


Fig. 112: Timing Chain Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

<<B>> ENGINE AND TRANSAXLE ASSEMBLY HOLDING

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

1. < Engine hanger MB991928 is used>
    1. Assemble the engine hanger (special tool MB991928). Set the following parts on the base hanger.
        - Slide bracket (HI)
        - Foot x 4 (standard) (MB991932)

- Joint x 2 (140) (MB991931)

2. Set the foot of the special tool as shown in the illustration below.

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

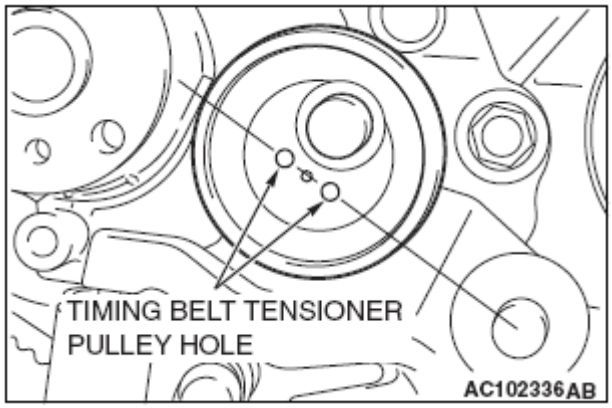


Fig. 113: Setting Foot Of Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

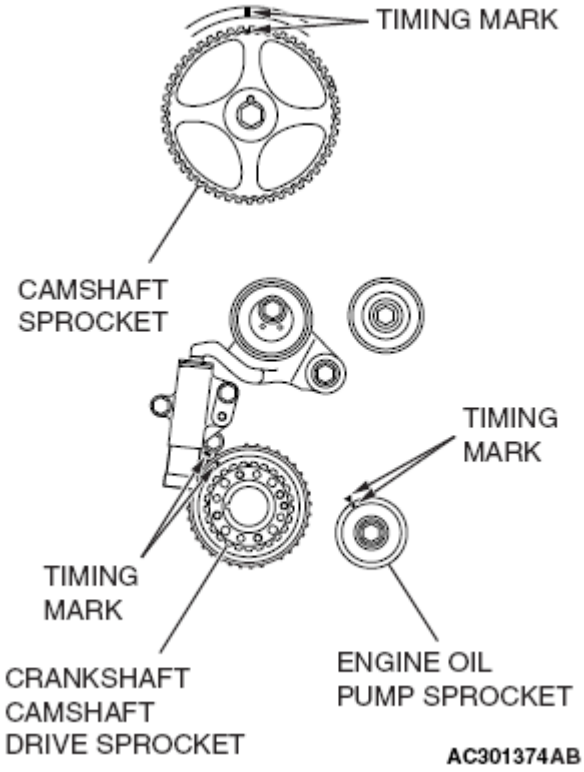


Fig. 114: Power Steering Oil Pump Bracket & Engine Hanger

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

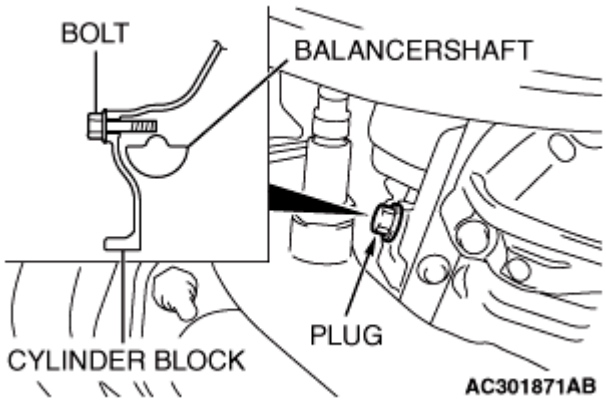


Fig. 115: Supporting Engine & Transaxle Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

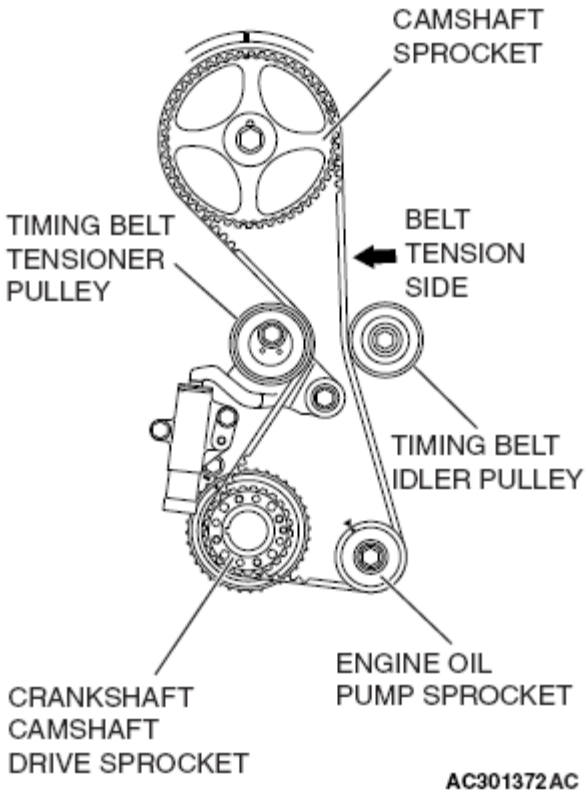


Fig. 116: Setting Foot Of Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

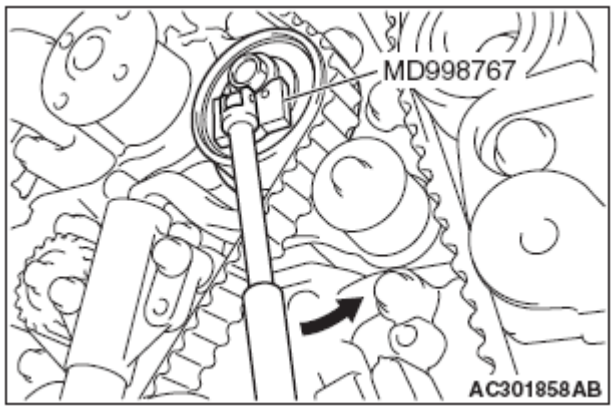


Fig. 117: Power Steering Oil Pump Bracket & Engine Hanger
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

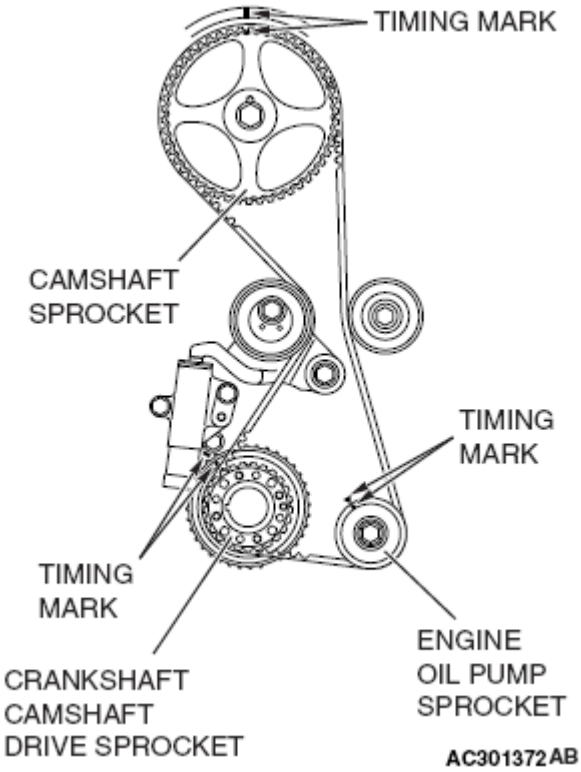


Fig. 118: Supporting Transaxle Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

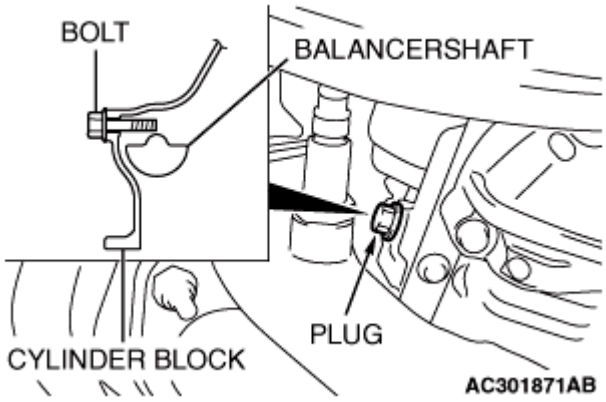


Fig. 119: Sliding Generator Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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 below using a flat-tipped screwdriver, and remove the timing chain case assembly from the cylinder head and cylinder block.

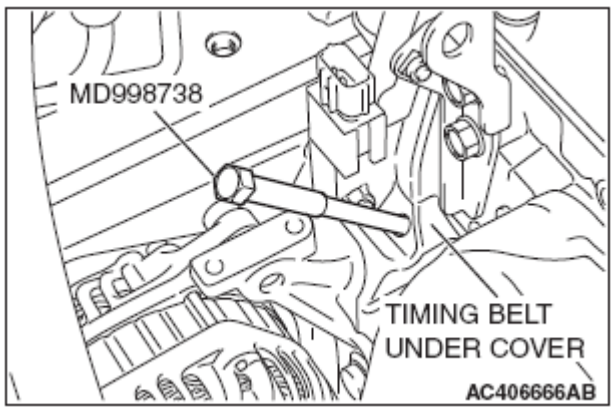


Fig. 120: Locating Boss
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

assembly from the cylinder head and cylinder block.

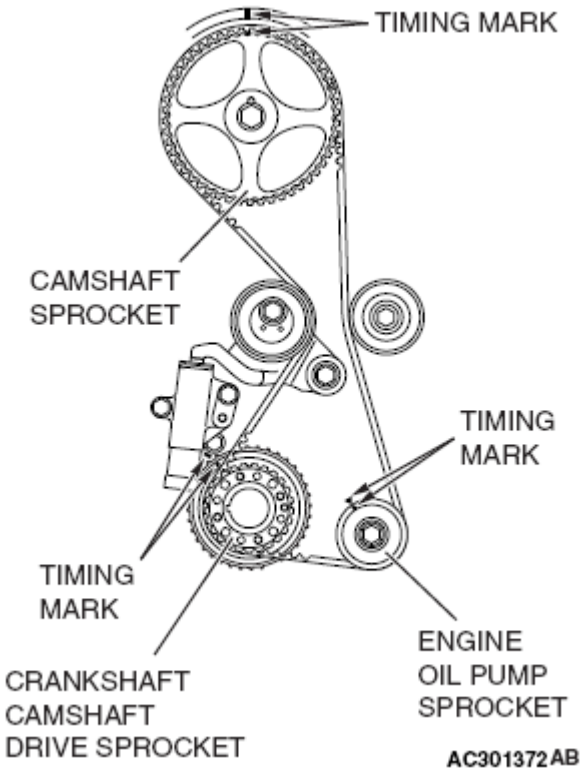


Fig. 121: Removing Timing Chain Case Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<F>> TIMING CHAIN TENSIONER REMOVAL

1. Temporarily install the crankshaft pulley to the crankshaft.

   CAUTION: Turn the crankshaft clockwise.

2. Turn the crankshaft clockwise to align the sprocket timing marks as shown in the illustration below and set the cylinder No. 1 to the top dead center of compression stroke.

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

3. Remove the crankshaft pulley installed temporarily.

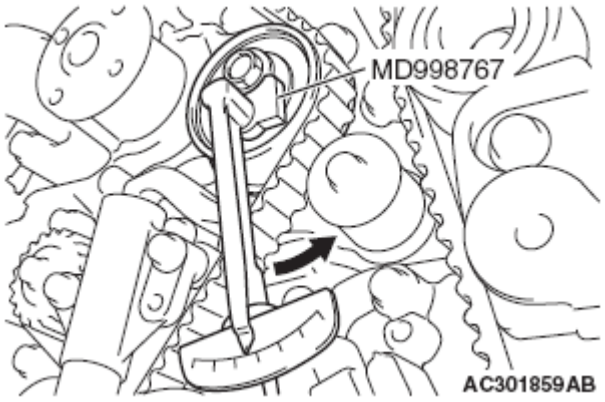


Fig. 122: Aligning Sprocket Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

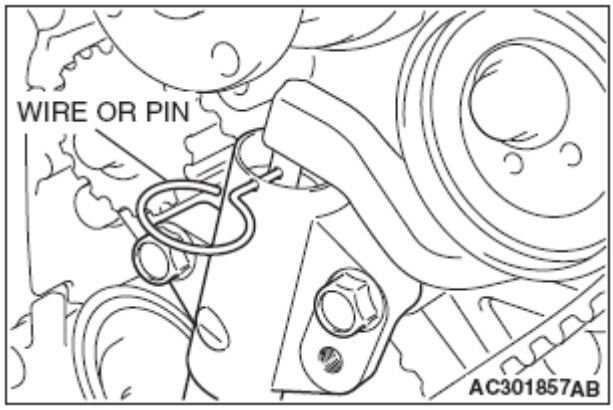


Fig. 123: Identifying Ratchet Release Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 below.

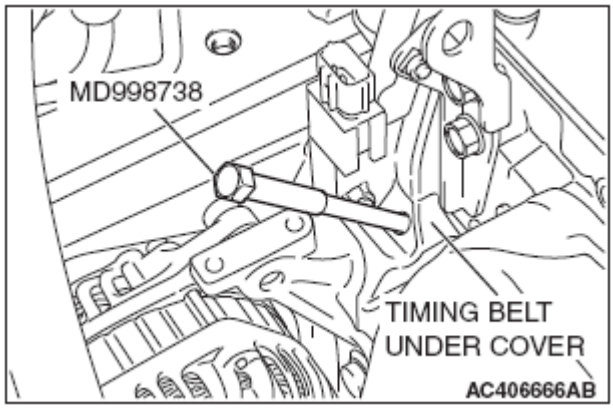


Fig. 124: Setting Timing Marks Of Camshaft/Crankshaft Sprockets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

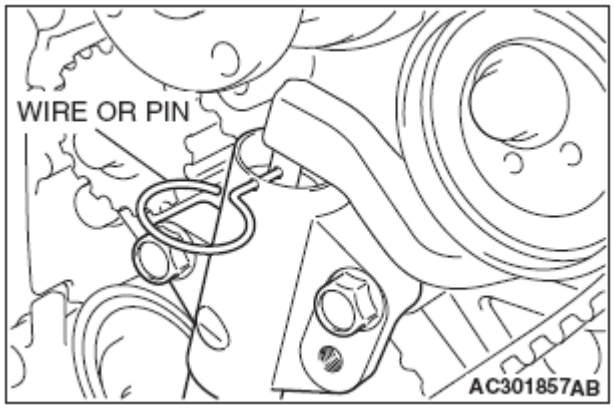


Fig. 125: Aligning Sprocket Timing Chain Mating Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< TIMING CHAIN TENSIONER INSTALLATION

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

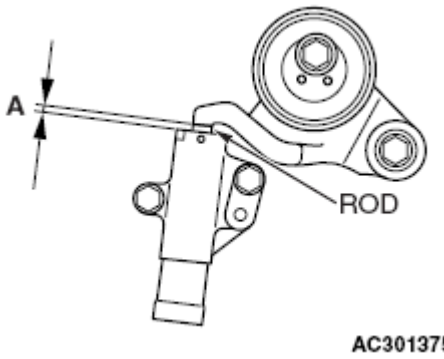


Fig. 126: Checking Sprocket Timing Chain Mating Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

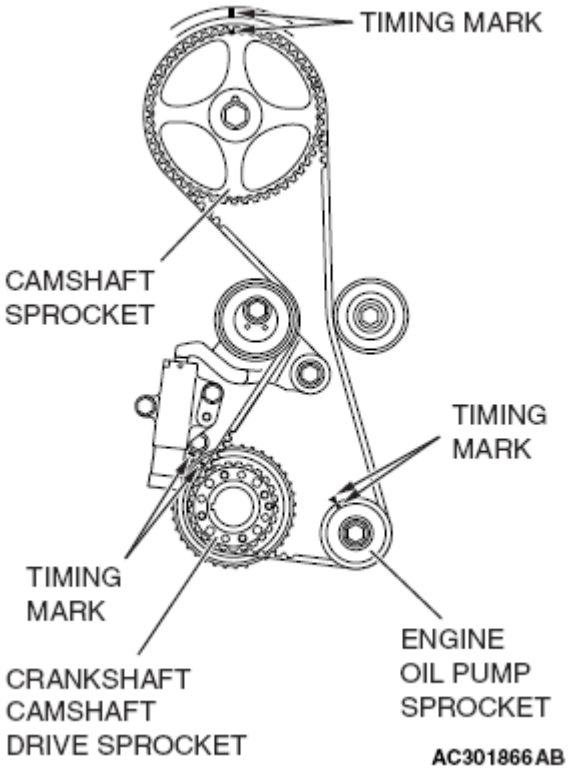


Fig. 127: Timing Chain Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

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

the crankshaft front oil seal.

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

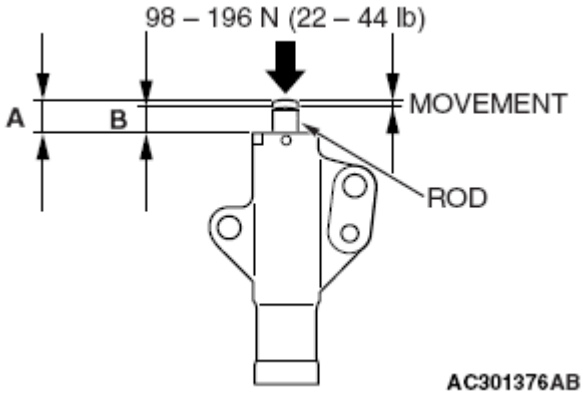


Fig. 128: Pressing Crankshaft Front Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 with degreasing agent, check that there is no oil on the surface where the sealant is applied.**
- **After degreasing with degreasing agent, 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. To the timing chain case assembly mating surface, apply the sealant with a width of 2.5 ± 0.5 mm (0.1 ± 0.02 inch) and without a gap. However, with the "A" shown in the illustration below, apply the sealant with overlapping 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 below.

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.

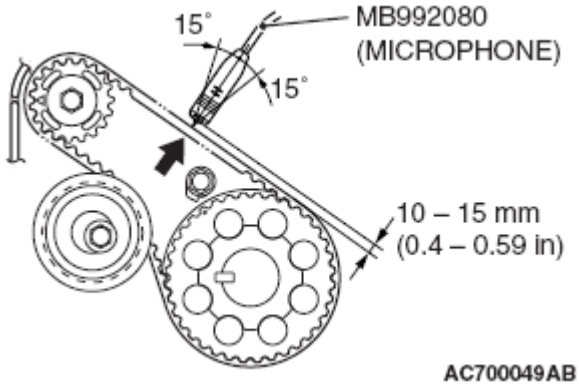


Fig. 129: Timing Chain Case Assembly Sealant Application Areas
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. To the installation positions shown in the illustration below, tighten the timing chain case assembly mounting bolts to the specified torque shown below.

TIGHTENING TORQUE SPECIFICATION

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

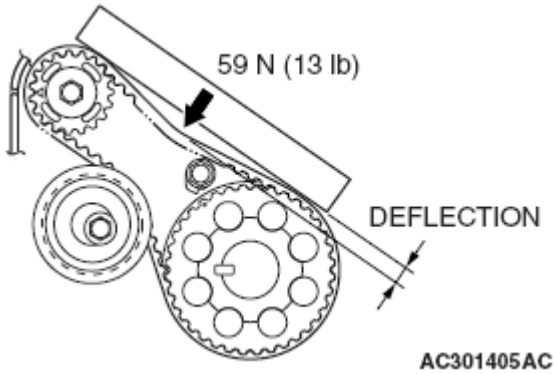


Fig. 130: Timing Chain Case Assembly Mounting Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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)

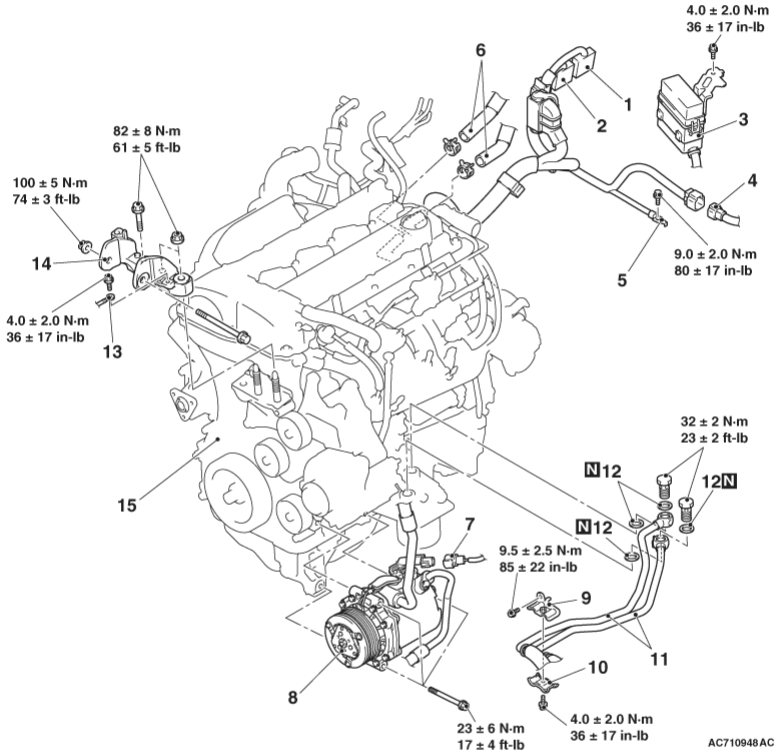
ENGINE ASSEMBLY

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 • Engine Room Under Cover Front A, B, Engine Room Under Cover Center and Engine Room Side Cover Removal • Engine Coolant Draining • Engine Oil Draining • Air Cleaner Assembly Removal • Charge Air Cooler Intake Hose A, B and Charge Air Cooler Intake Pipe A Removal • Engine Control Harness Connector Bracket Removal	• Engine Control Harness Connector Bracket Installation • Charge Air Cooler Intake Hose A, B and Charge Air Cooler Intake Pipe A Installation • Air Cleaner Assembly Installation • Engine Oil Refilling • Engine Coolant Refilling • Fuel Leak Check • Engine Room Under Cover Front A, B, Engine Room Under Cover Center and Engine Room Side Cover Installation



Removal steps

- Power steering oil pump assembly

1. Joint connector (CAN 4) connection <TC-SST>
2. Front wiring harness and control wiring harness combination
3. Relay box
4. Front wiring harness and control wiring harness combination
5. Grounding connection
6. Heater hose connection
7. A/C compressor assembly connector

<<A>> >>B<<

8. A/C compressor and clutch assembly
9. Engine oil cooler hose bracket
10. Engine oil cooler line clamp
11. Engine oil cooler hose connection
12. Gasket
    - Hood assembly
    - Radiator condenser tank bracket
    - Fuel pump resistor
13. Grounding cable connection
    - Transaxle assembly

<<B>> >>A<<

<<B>> >>A<<

14. Engine mounting bracket
15. Engine assembly

Fig. 131: Engine Assembly With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

REMOVAL SERVICE POINTS

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

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

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

1. Place a garage jack against the engine oil pan with a piece of wood in between to support the engine assembly.
2. When the transaxle assembly is removed, remove special tool MB991928 or MB991895 which supports the engine assembly.

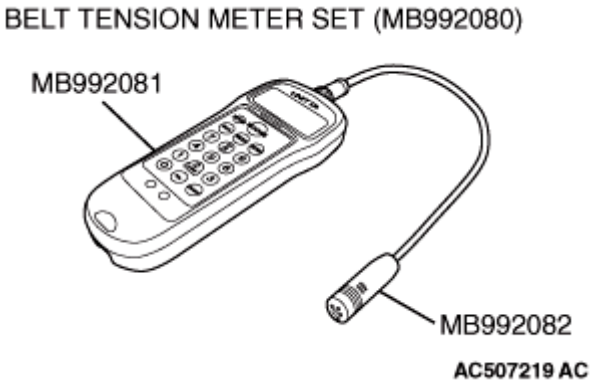
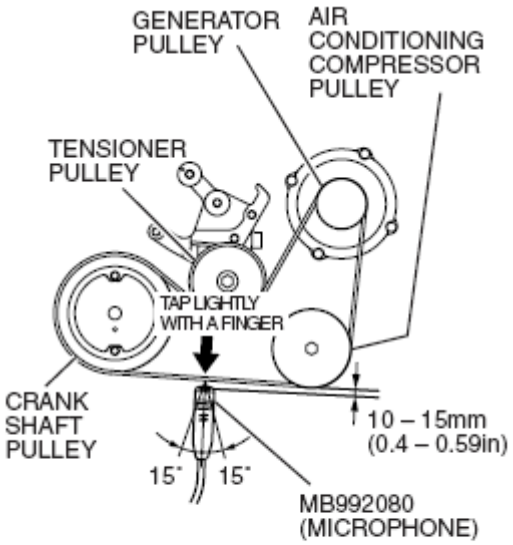


Fig. 132: Supporting Engine Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



AC600756 AB

Fig. 133: Supporting Engine Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

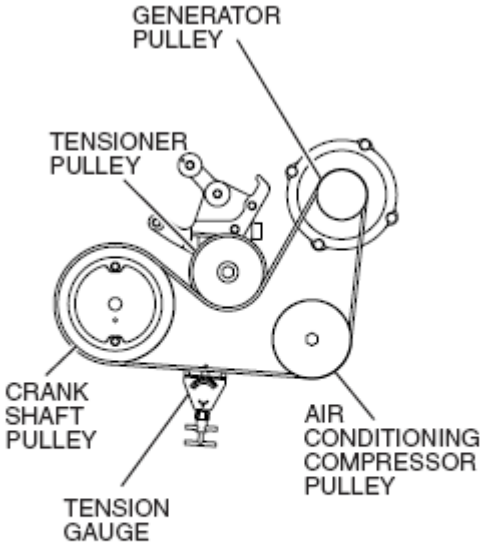


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Fig. 134: Power Steering Oil Pump Bracket & Engine Hanger
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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, lift the engine assembly slowly with the chain block to remove the engine assembly upward from the engine compartment.

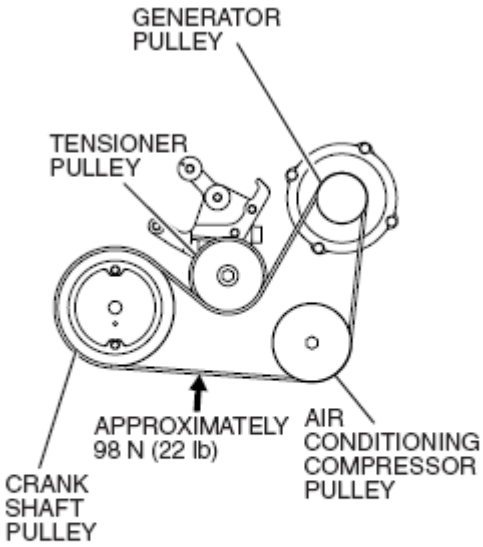

Fig. 135: Holding Engine Assembly With Chain Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

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

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

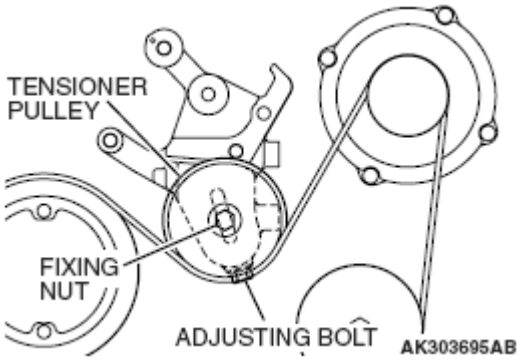

Fig. 136: Holding Engine Assembly With Chain Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Install special tool MB991928 or MB991895 which is used during installation of transaxle assembly to hold the engine assembly. (Refer to **TRANSAXLE ASSEMBLY** <M/T>), (Refer to **TRANSAXLE ASSEMBLY** <TC-SST>)

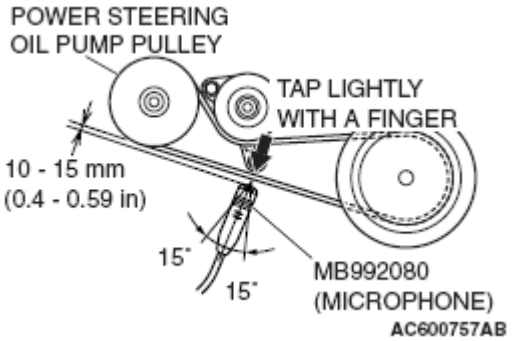

Fig. 137: Supporting Engine Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

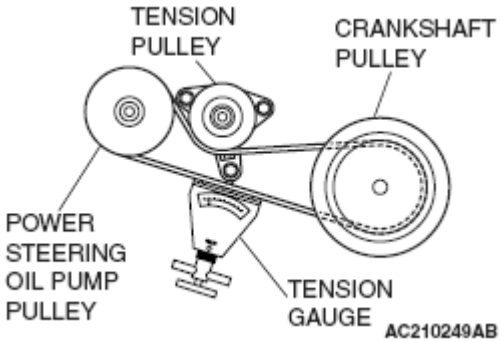

Fig. 138: Supporting Engine Assembly Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 below.

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

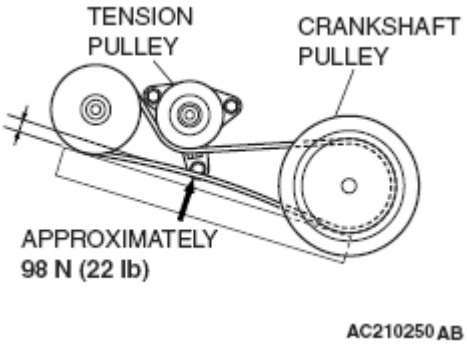

Fig. 139: A/C Compressor & Clutch Assembly Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

