2011 ENGINE

Engine Mechanical <2.4L Engine> - Eclipse

GENERAL DESCRIPTION

The 4G69 (2.4L) engine is an in-line four cylinder engine. The cylinder numbers are assigned as 1 - 2 - 3 - 4 from the front of the engine (timing belt side). This engine is fired in the order of the 1, 3, 4 and 2 cylinders.

ITEM SPECIFICATION

ITEM			SPECIFICATION
Type			In-line SOHC
Number of cylinders			4
Bore mm (in)			87 (3.43)
Stroke mm (in)			100.0 (3.94)
Total displacement cm^3 (cu in)			2,378 (145.1)
Compression ratio			9.5
Firing order			1 - 3 - 4 - 2
Counterbalance shaft			Equipped
Valve timing	Intake valve	Opens (BTDC)	6° <Low speed>
			20° <High speed cam>
		Closes (ABDC)	38° <Low speed cam>
			72° <High speed cam>
	Exhaust valve	Opens (BBDC)	60°
		Closes (ATDC)	16°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Involute gear type

ENGINE DIAGNOSIS

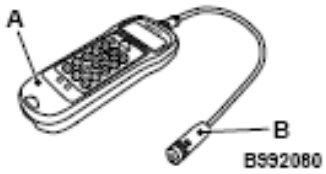
SYMPTOM CHART

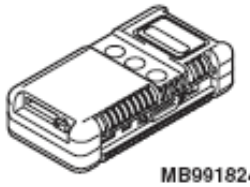
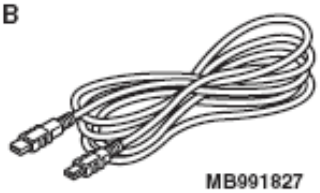
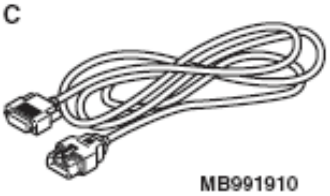
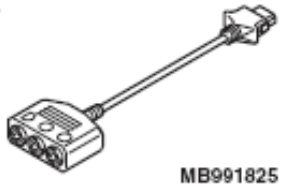
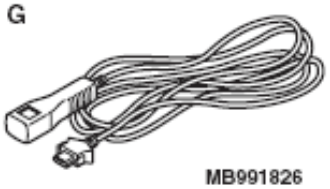
SYMPTOM	PROBABLE CAUSE	REMEDY
Compression is too low	Blown cylinder head gasket	Replace the gasket
	Worn or damaged piston rings	Replace the rings
	Worn piston or cylinder	Repair or replace the piston and/or the cylinder block
	Worn or damaged valve seat	Repair or replace the valve and/or the seat ring
	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

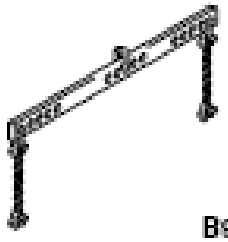
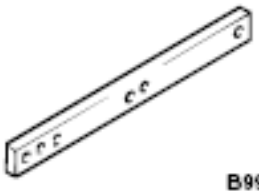
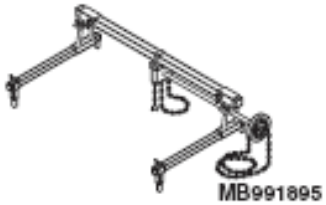
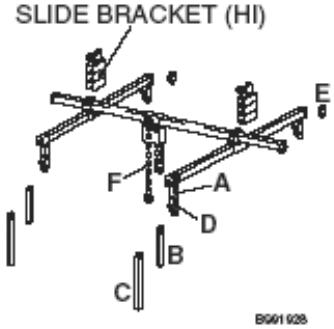
Drop in engine oil pressure	Worn oil pump gears or cover	Replace the gears and/or the cover
	Thin or diluted engine oil	Change the engine oil to correct viscosity
	Stuck (opened) oil relief valve	Repair the relief valve
	Excessive bearing clearance	Replace the bearings
Engine oil pressure too high	Stuck (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
	Low engine oil pressure	Refer to engine oil pressure drop symptoms above
	Thin or diluted engine oil	Change the engine oil
	Excessive bearing clearance	Replace the bearings

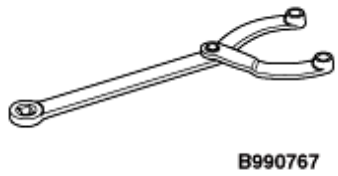
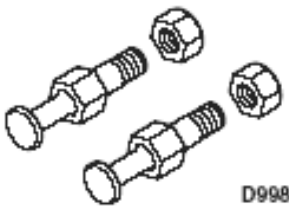
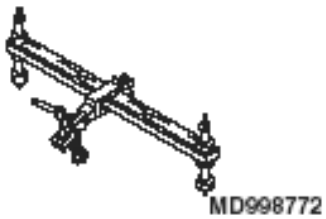
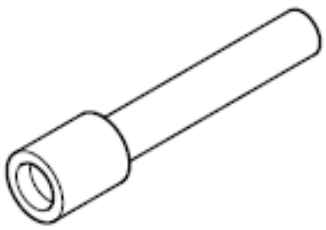
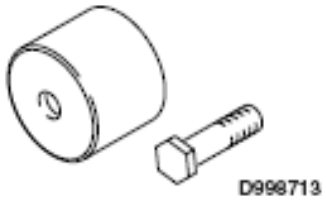
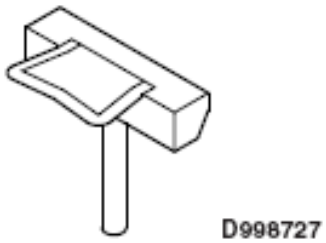
SPECIAL TOOLS

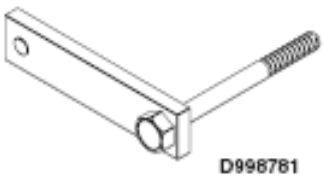
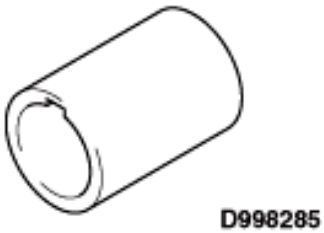
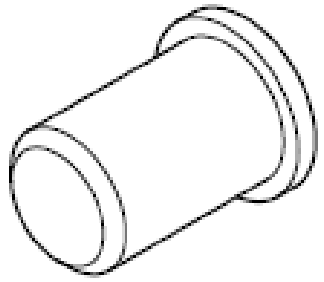
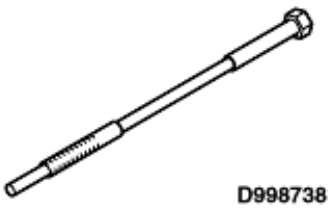
SPECIAL TOOLS SPECIFICATION

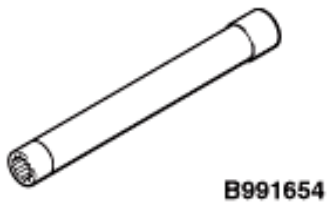
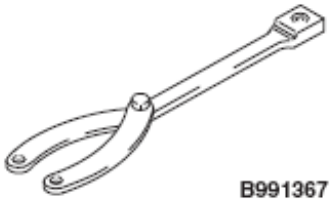
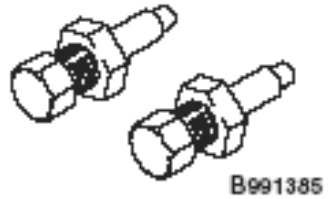
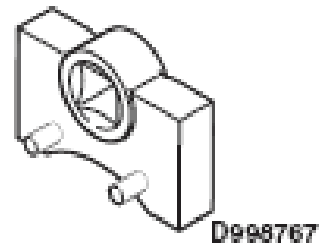
TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
	MB992080 Belt tension meter set A. MB992081 Belt tension meter B. MB992082 Microphone assembly	Tool not available	• Drive belt tension check • Balancer timing belt tension check
	MB991958 Scan tool (M.U.T.-III sub assembly) A. MB991824 Vehicle communication interface (V.C.I.) B. MB991827		

A  MB991824 B  MB991827 C  MB991910 D  MB991911 E  MB991914 F  MB991825 G  MB991826 MB991958	M.U.T.-III USB cable C. MB991910 M.U.T.-III main harness A (Vehicles with CAN communication system) D. MB991911 M.U.T.-III main harness B (Vehicles 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:** **G: MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.**	**CAUTION:** **For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** • Ignition timing check • Curb idle speed check • Idle mixture check
	MB991454 Engine hanger balancer	MZ203827-01	

			When the engine hanger is used: Supporting the engine assembly during removal and installation of the transaxle assembly **NOTE:** **Special tool MB991454 is a part of engine hanger attachment set MB991453.**
	MB991527 Hanger	Tool not available	
	MB991895 Engine hanger	Tool not available	
SLIDE BRACKET (HI) 	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	Tool not available	

	Chain and hook assembly		
 B990767	MB990767 Front hub and flange yoke holder	MB990767-01	Holding the camshaft sprocket
 D998719	MD998719 Pin	MIT308239	
 MD998772	MD998772 Valve spring compressor	General service tool	Compressing valve spring
	MB991999 Valve stem seal installer	-	Valve stem seal installation
 D998713	MD998713 Camshaft oil seal installer	MD998713-01	Camshaft oil seal installation
 D998727	MD998727 Oil pan FIPG cutter	MD998727-01	Oil pan removal
	MD998781 Flywheel stopper	General service tool	Securing the flywheel assembly <M/T> or A/T

 D998781			drive plate <A/T>
	MB990938 Installer bar	MB990938-01	Crankshaft rear oil seal installation
 D998776	MD998776 Crankshaft rear oil seal installer	MD998776-01	
 D998285	MD998285 Crankshaft front oil seal guide	MD998285-01	Crankshaft front oil seal installation
	MD998375 Crankshaft front oil seal installer	MD998375-01	
 D998738	MD998738 Adjusting bolt	MD998738-01	Supporting the timing belt tensioner arm and timing belt tensioner adjuster
	MB991654 Cylinder head bolt	General service tool	Removal and installation of

 B991654	wrench (12)		cylinder head bolt
 B991367	MB991367 Special spanner	MB991367-01	Holding the crankshaft camshaft drive sprocket
 B991385	MB991385 Pin	MIT217213	
 D998767	MD998767 Tensioner wrench	MD998752-01	Valve timing belt tension adjustment

ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK

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

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

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

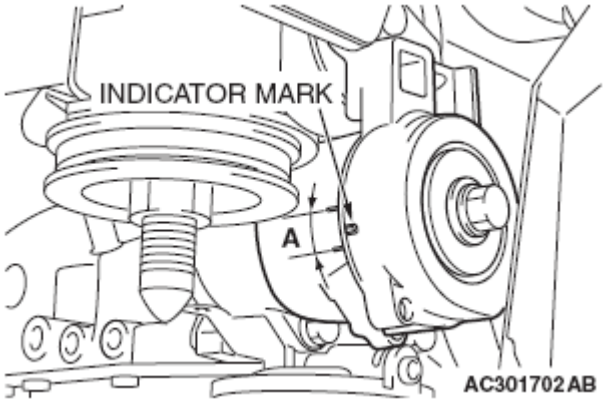


Fig. 1: Identifying Indicator Mark Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

AUTO-TENSIONER CHECK

OPERATION CHECK

1. Turn OFF the engine from the idle state then check to see that the drive belt is not protruding from the pulley width of the auto-tensioner.
2. Remove the drive belt. (Refer to **CRANKSHAFT PULLEY**).
3. Securely insert the spindle handle or ratchet handle with a 12.7 mm (1/2-inch) insertion angle into the jig hole of the auto tensioner. Turn the auto-tensioner to the left and right to check and see that there is no threading.
4. If there are any problems in the procedure 1 or 3, replace the auto-tensioner. (Refer to **TIMING BELT**).
5. Install the drive belt. (Refer to **CRANKSHAFT PULLEY**).

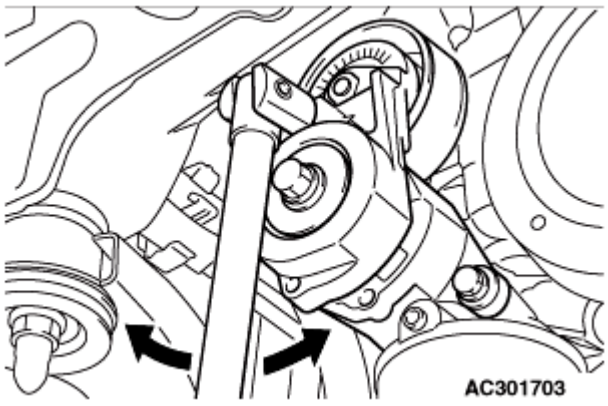


Fig. 2: Checking Auto-Tensioner Operation
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

FUNCTION CHECK

You can verify if the auto-tensioner is defective or not by checking the drive belt tension.

<When using special tool MB992080: Recommendation>

Required Special Tools:

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

1. Check the drive belt tension. (Refer to **ON-VEHICLE SERVICE**).

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

2. Measure the drive belt tension vibration frequency by the following procedures:
   1. Connect special tool MB992082 to special tool MB992081 of special tool MB992080.
   2. Press the "POWER" button to turn on the power supply.
   3. Press the numeral key of "1" and check that "No. 1" appears on the upper left of the display.

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

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

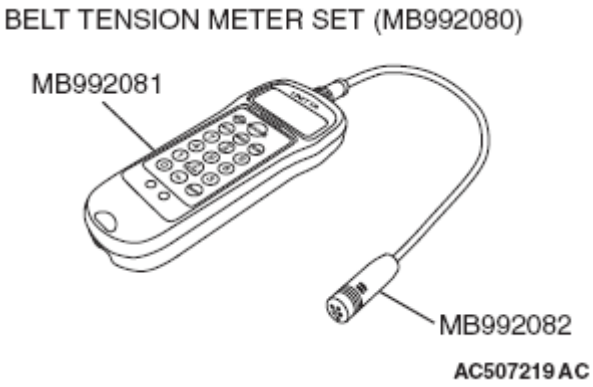


Fig. 3: Identifying Belt Tension Meter Set (MB992080)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION:
- **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.**

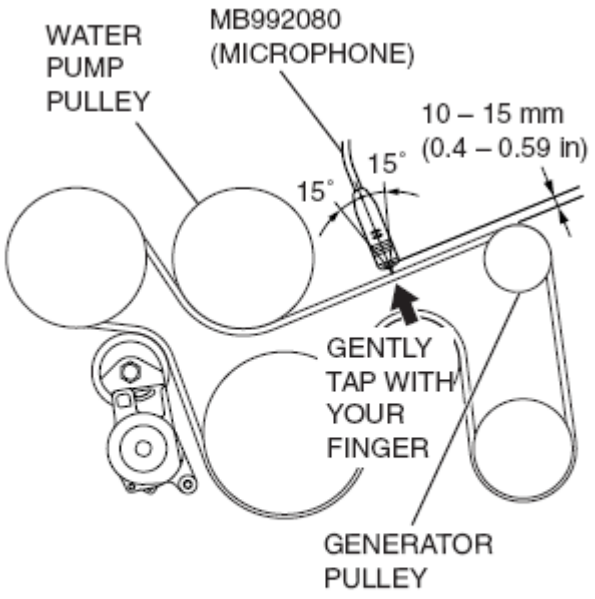
5. Hold special tool MB992080 to the middle of the drive belt between the pulleys (at the place indicated by arrow), approximately 10 - 15 mm (0.4 - 0.59 inch) away from the rear surface of the belt so that it is perpendicular to the belt (within an angle of ± 15 degree).
6. Press the "MEASURE" button.
7. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and measure that the vibration frequency of the belt is within the standard value.

   Standard value: 120 - 154 Hz

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

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

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



AC600761AB

Fig. 4: Measuring Vibration Frequency Of Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<When using a tension gauge>

1. Check the drive belt tension. (Refer to **ON-VEHICLE SERVICE**).

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

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

   Standard value: 340 - 562 N (76 - 126 pounds)

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

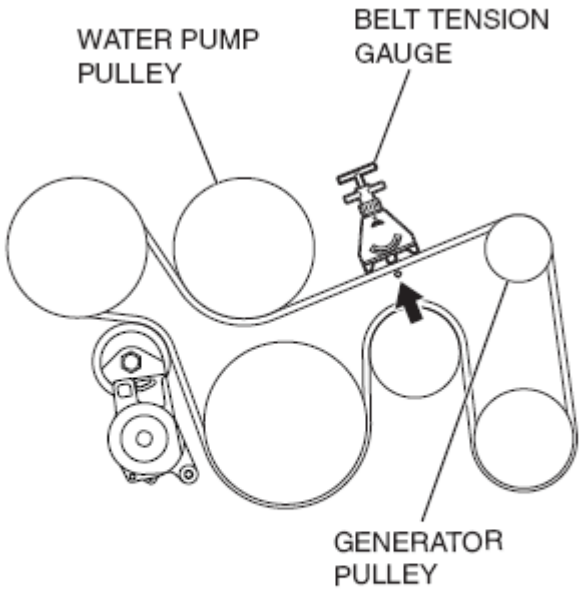


Fig. 5: Measuring Belt Tension
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

VALVE CLEARANCE CHECK AND ADJUSTMENT

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

ROCKER ARM PISTON OPERATION CHECK

1. Remove all of the ignition coils.
2. Remove the rocker cover.
3. Remove the engine oil control valve.
4. Remove the engine oil pressure switch.
5. Turn the crankshaft clockwise until the notch on the crankshaft pulley is lined up with "T" mark on the lower cover of timing belt.
6. Move the rocker arms on the No. 1 and No. 4 cylinders up and down by hand to determine which cylinder has its piston at the top dead center on the compression stroke.

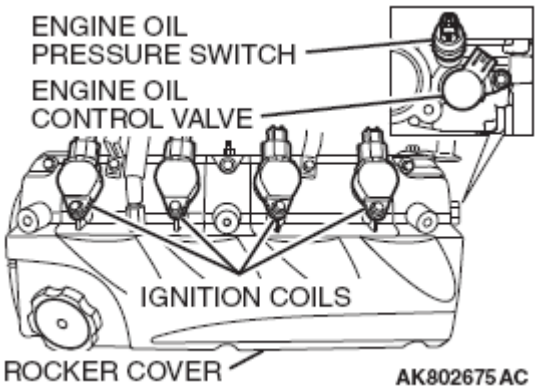


Fig. 6: Identifying Ignition Coils, Rocker Cover, Engine Oil Control Valve And Pressure Switch
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

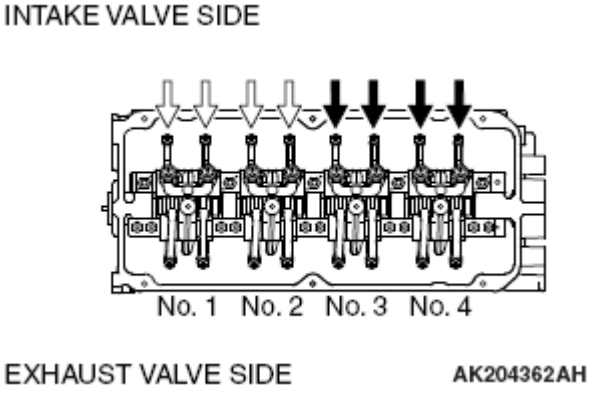


Fig. 7: Identifying Rocker Arm Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. While shutting up the oil passage hole at the depth of the engine oil control valve's installation hole by finger not to leak air, blow compressed air into the engine oil pressure switch's installation hole by air blowgun. At this time, confirm that the rocker arm piston can operate.

NOTE: To fully confirm the check, prevent the compression air from leaking as much as possible by bind vinyl tape to the end of air blowgun. The compression air pressure is required more than 620 kPa (90 psi).

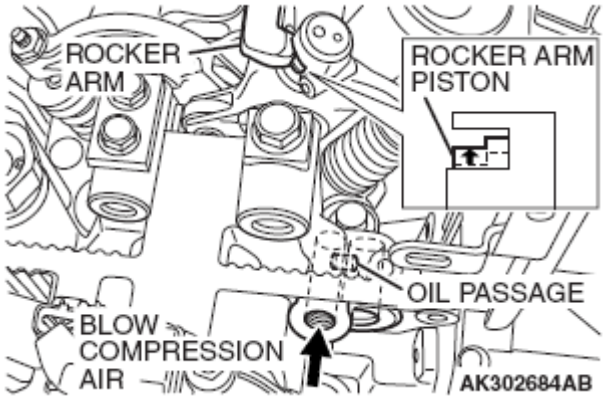


Fig. 8: Blowing Compressed Air Into Engine Oil Pressure Switch's Installation Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

IGNITION TIMING CHECK

Required Special Tool:

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

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

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

- Lights and all accessories: OFF
- Transaxle: Neutral (P range on vehicles with A/T)

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. Turn the ignition switch to the "LOCK" (OFF) position and connect the scan tool MB991958 to the data link connector.

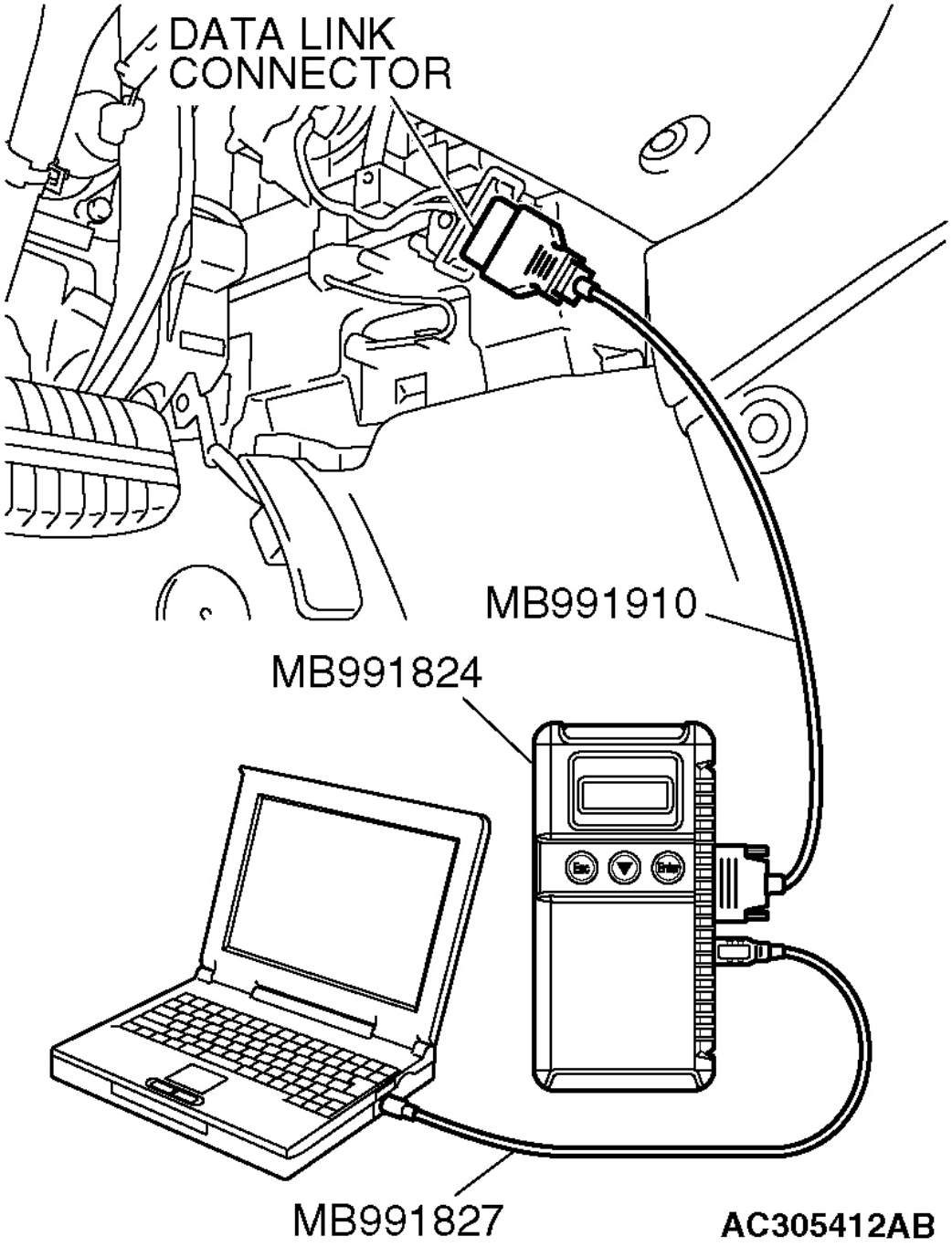


Fig. 9: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set a timing light to the terminal No. 1 power supply line (black-orange) of the ignition coil No. 1.

4. Start the engine and run it at idle.
5. Check that the idle speed is approximately 700 r/min.
6. Select the 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, check the following items:
   - Diagnostic output
   - Timing belt cover and crankshaft position sensor installation conditions
   - Crankshaft sensing blade condition

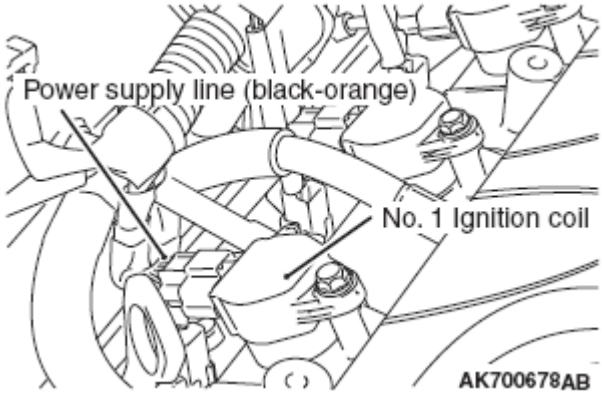


Fig. 10: Identifying Power Supply Line (Black-Orange) And No. 1 Ignition Coil
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

    Standard value: Approximately 10° BTDC

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

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

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

11. Remove the timing light.
12. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the 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 A/T)

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. Turn the ignition switch to the "LOCK" (OFF) position and connect the scan tool MB991958 to the data link connector.

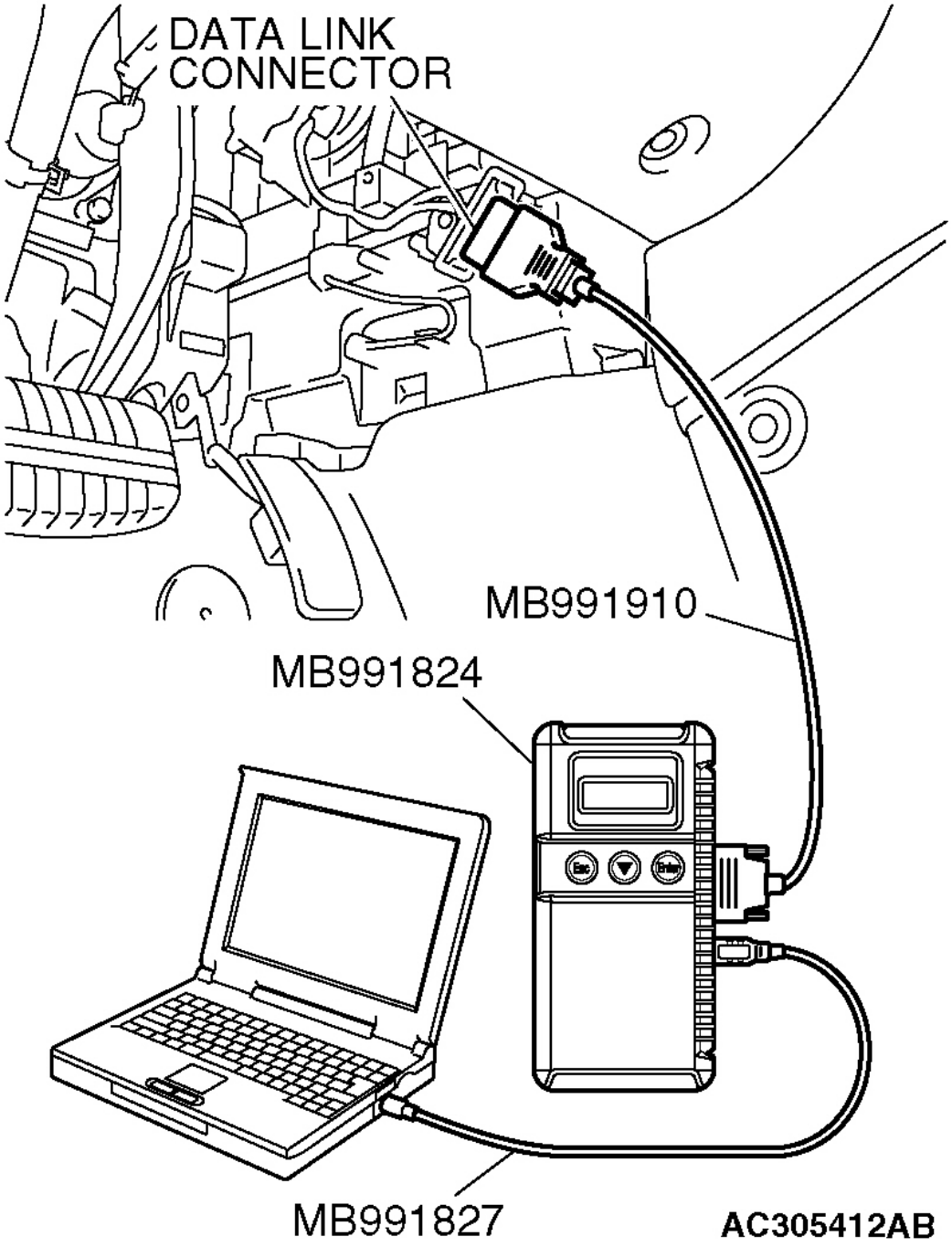


Fig. 11: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set a timing light to the terminal No. 1 power supply line (black-orange) of the ignition coil No. 1.

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

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

Standard value: Approximately 10° BTDC

NOTE: Ignition timing fluctuates ± 7°, even under normal operating condition.

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

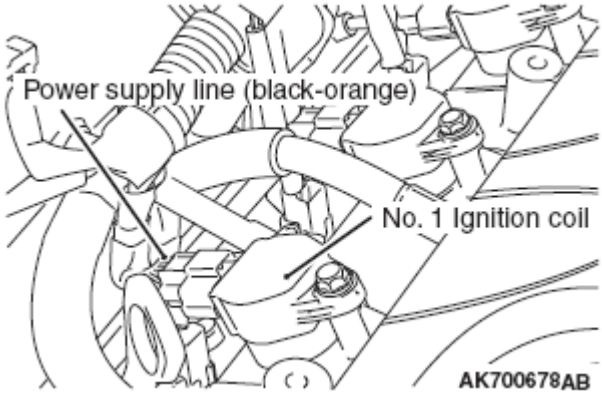


Fig. 12: Identifying Power Supply Line (Black-Orange) And No. 1 Ignition Coil
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Curb idle speed: 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.
10. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the 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 A/T)

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. Turn the ignition switch to the "LOCK" (OFF) position and connect the scan tool MB991958 to the data link connector.
3. Start the engine and increase the engine speed to 2,500 r/min for 2 minutes.
4. Check that the actual ignition timing is within the standard value.

   Standard value: Approximately 10° BTDC

NOTE: Ignition timing fluctuates ± 7°, even under normal operating condition.

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

5. Set the CO, HC tester.
6. Check the CO contents and the HC contents at idle.

   Standard value:

   CO contents: 0.5% or less

   HC contents: 100 ppm or less

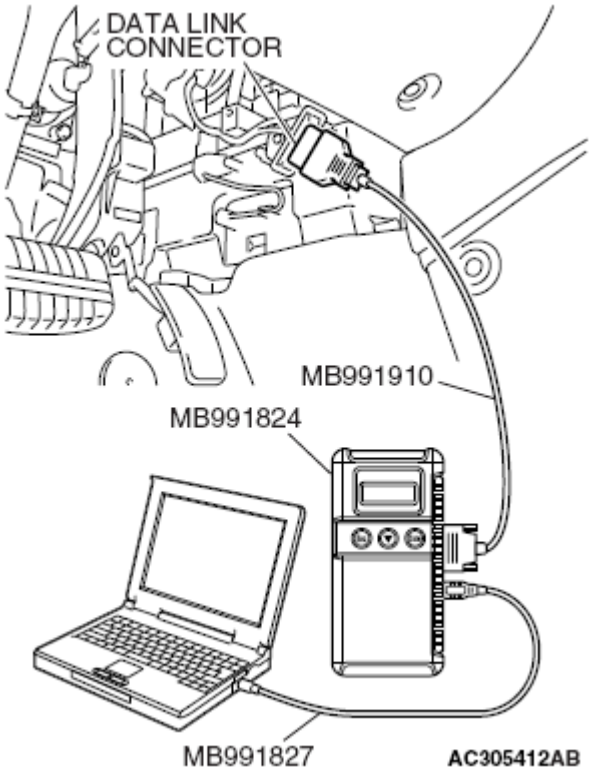


Fig. 13: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. If the CO and HC contents do not remain inside the standard value, refer to **SYMPTOM CHART** .
8. Remove the timing light and CO, HC tester.
9. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the 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 A/T)

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. Remove all of the ignition coils and spark plugs.
4. Disconnect the crankshaft position sensor connector.

NOTE: Doing this will prevent the engine control module or powertrain control module from carrying out ignition and fuel injection.

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., during cranking. After the engine has been cranked, check for foreign material adhering to the shop towel.

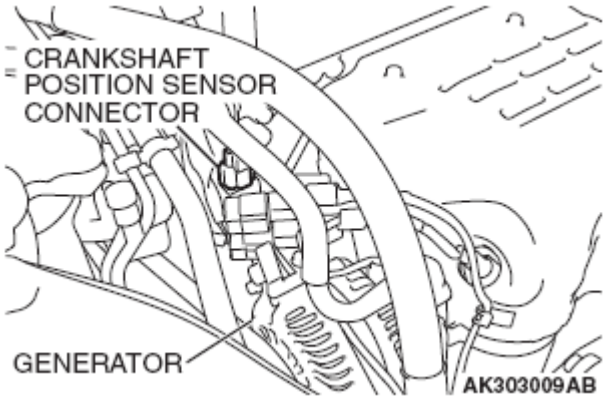


Fig. 14: Identifying Crankshaft Position Sensor Connector And Generator
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Standard value (at engine speed of 200 r/min):

1,560 kPa (226 psi)

Minimum limit (at engine speed of 200 r/min):

1,130 kPa (164 psi)

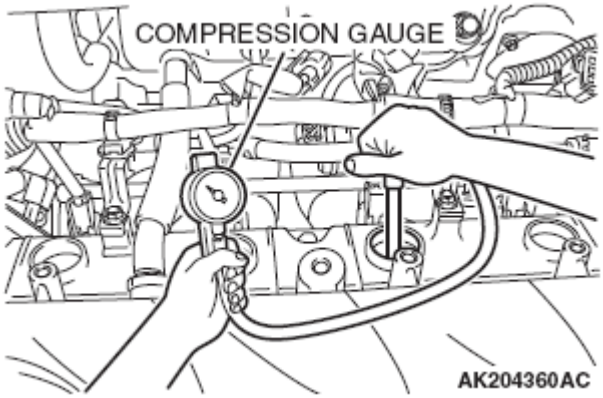


Fig. 15: Measuring Compression Pressure
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   Limit: 98 kPa (14 psi)

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 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 crankshaft position sensor connector.
11. Install the spark plugs and ignition coils.
12. Use the scan tool MB991958 to erase the diagnostic trouble codes.

NOTE: This will erase the diagnostic trouble code resulting from the crankshaft position sensor connector being disconnected.

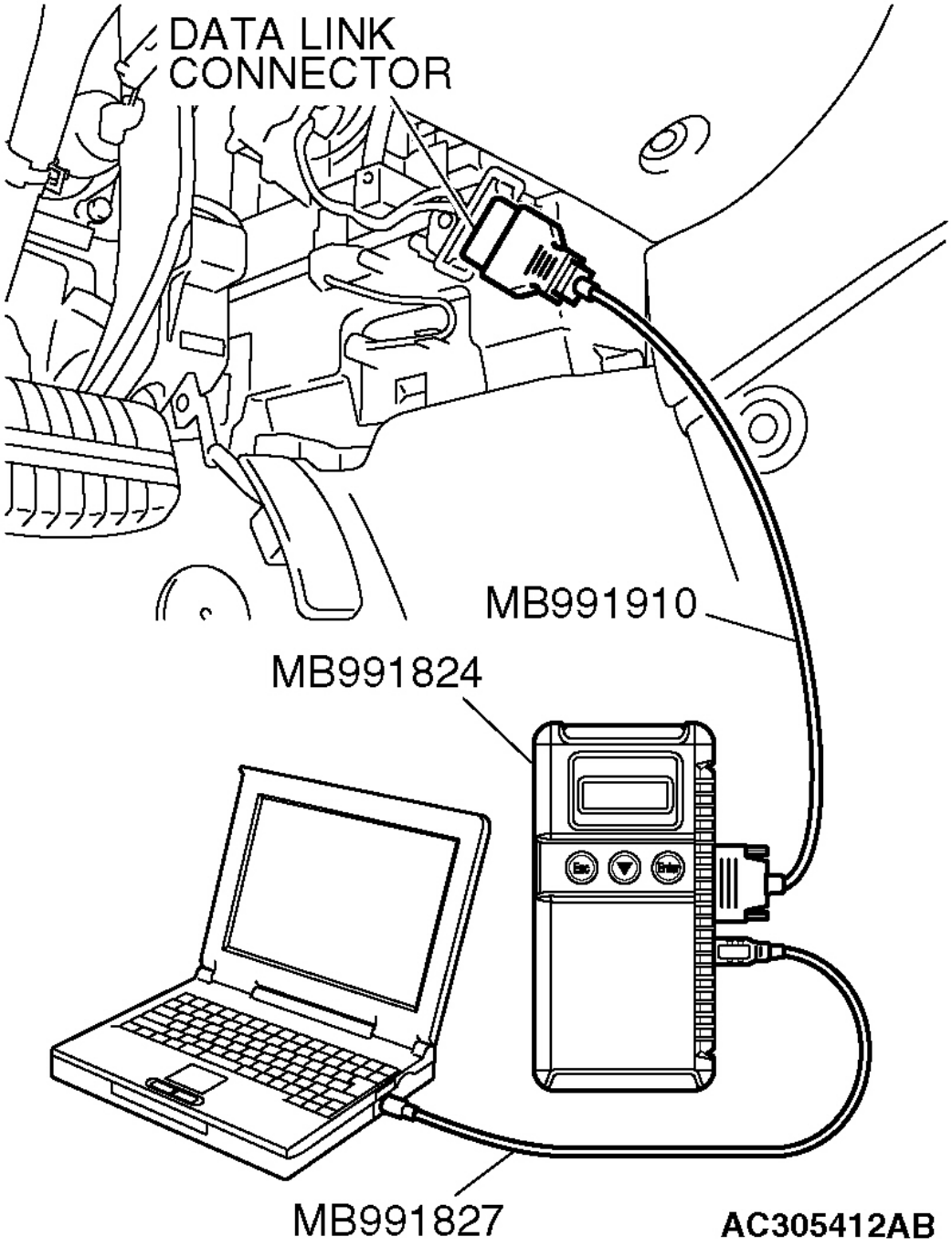


Fig. 16: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

MANIFOLD VACUUM CHECK

Required Special Tool:

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

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

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

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.

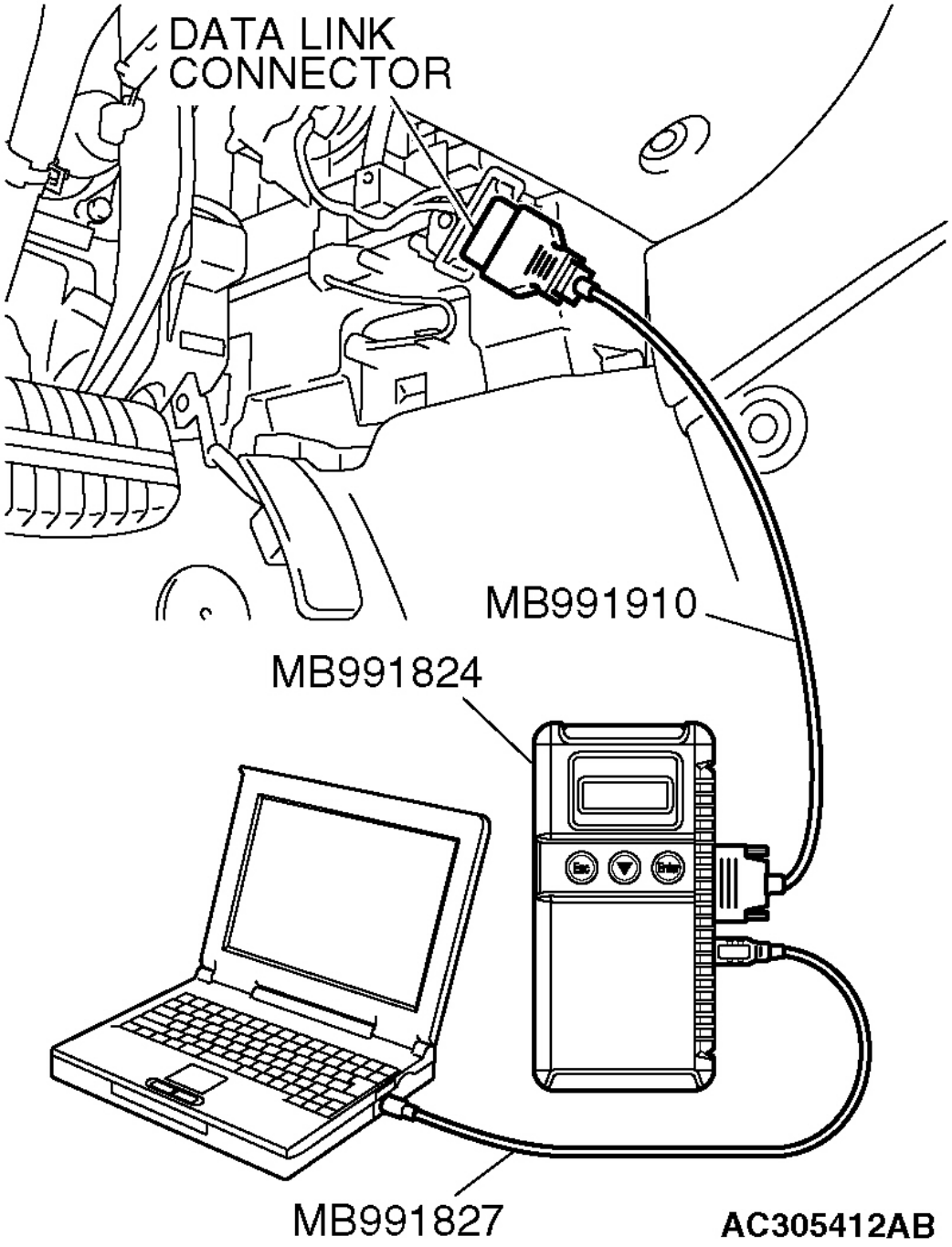


Fig. 17: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Turn the ignition switch to the "LOCK" (OFF) position and connect the scan tool MB991958 to the data

link connector.

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

   Limit: Minimum 60 kPa (18 in Hg)

6. Turn the ignition switch to the "LOCK" (OFF) position.
7. Remove the vacuum gauge and then connect the ventilation hose to the PCV valve.
8. Disconnect scan tool MB991958 from the data link connector.

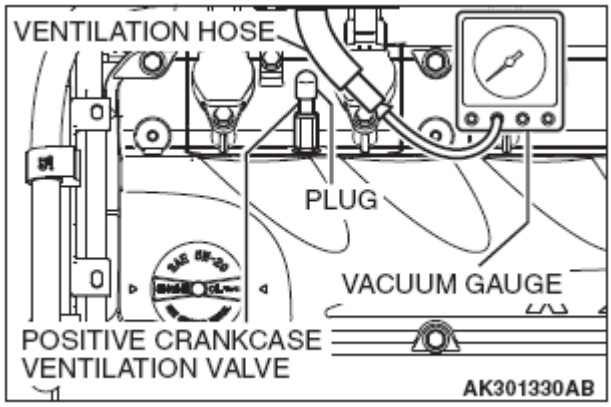


Fig. 18: Checking Intake Manifold Vacuum
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

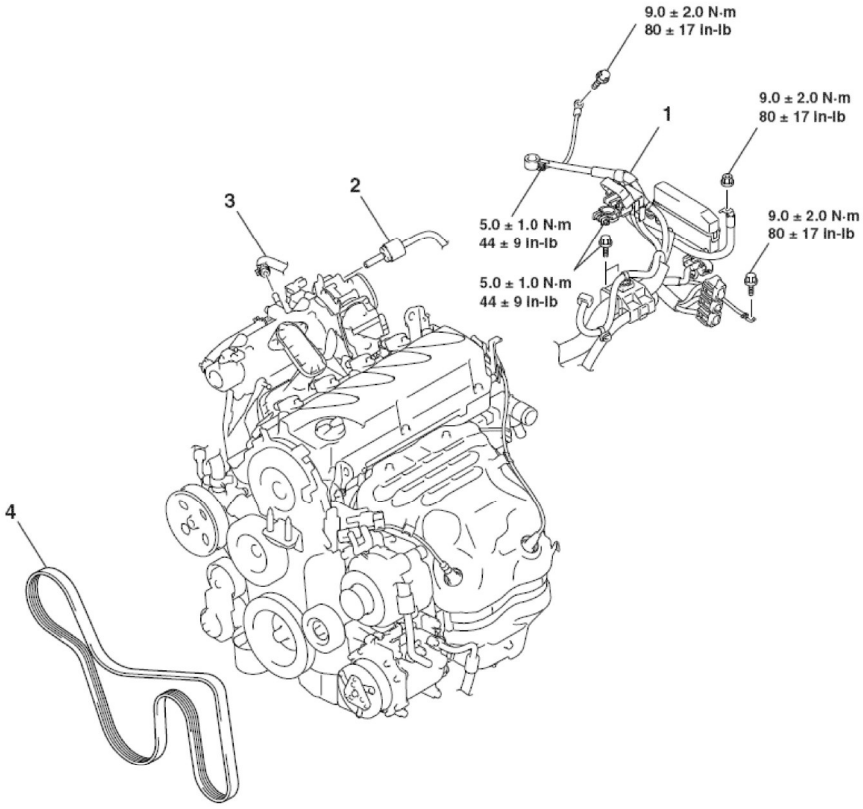
ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

CAUTION:

- **When the engine assembly replacement is performed, use scan tool MB991958 to initialize the learning value (Refer to INITIALIZATION PROCEDURE FOR LEARNING VALUE IN MFI ENGINE).**
- ***: indicates parts which should be temporarily tightened, and then fully tightened with the engine weight applied on the vehicle body.**

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



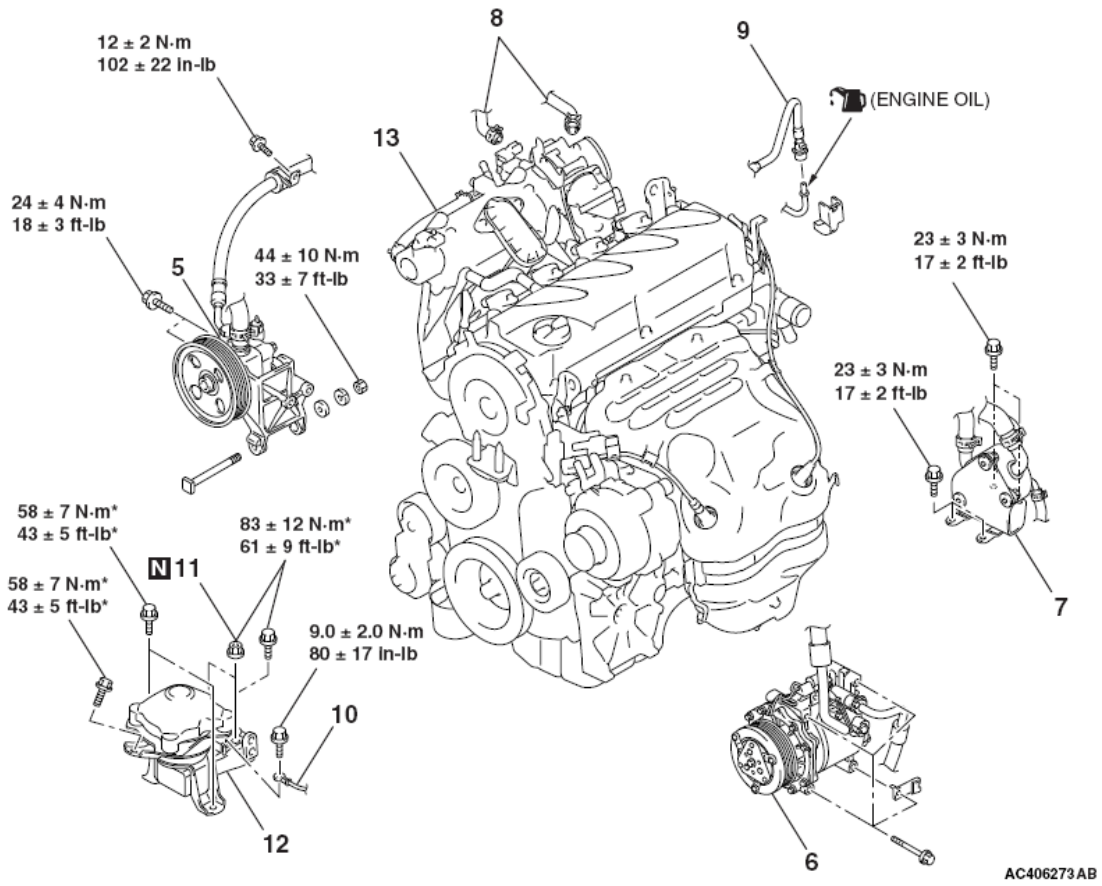
REMOVAL STEPS

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: Removal/Installation Of Engine Assembly Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



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			11. JAM NUTS
<<E>>	>>D<<	9. FUEL HIGH-PRESSURE HOSE CONNECTION	<<H>>	>>B<<	12. ENGINE FRONT MOUNTING BRACKET
			<<I>>	>>A<<	13. ENGINE ASSEMBLY

Fig. 20: Removal/Installation Of Engine Assembly Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

REMOVAL SERVICE POINTS

<<A>> DRIVE BELT REMOVAL

The following operations are required due to the serpentine drive system with the drive belt auto-tensioner.

1. Securely insert the spindle handle or ratchet handle at a 12.7 mm (1/2-inch) angle into the jig hole of the auto-tensioner.
2. Rotate the auto-tensioner counterclockwise and align hole A with hole B.

CAUTION: To reuse the drive belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

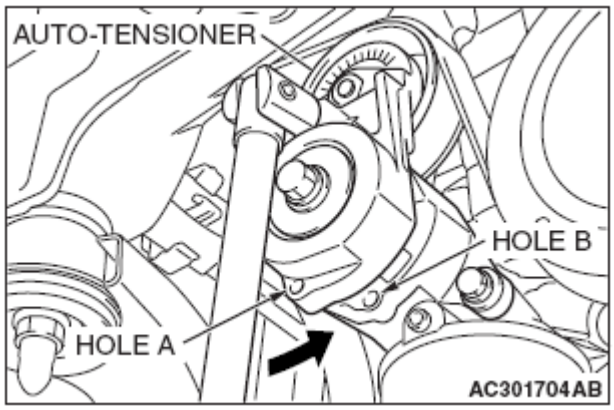


Fig. 21: Rotating Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Insert an L-shaped hexagon wrench, etc. into the hole to secure its position, and then remove the drive belt.

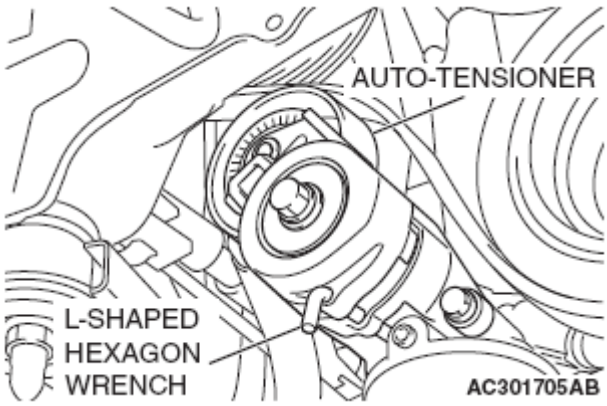


Fig. 22: Securing Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

1. With the hose installed, remove the power steering oil pump and bracket assembly from the engine assembly.

2. After removing the power steering oil pump and bracket assembly, secure it with a cord in a location where it does not interfere with engine assembly removal.

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

1. With the hose installed, remove the A/C compressor and clutch assembly from the bracket.
2. After removing the A/C compressor and clutch assembly, secure it with a cord in a location where it does not interfere with engine assembly removal.

<<D>> ATF WARMER (TRANSMISSION FLUID COOLER) AND BRACKET ASSEMBLY REMOVAL

With the hose installed, remove the ATF warmer (transmission fluid cooler) and bracket assembly from the transaxle case front roll stopper bracket.

<<E>> FUEL HIGH-PRESSURE HOSE DISCONNECTION

1. Remove the fuel high-pressure hose stopper.

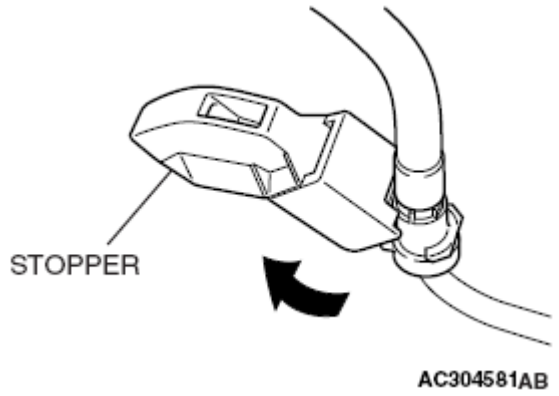


Fig. 23: Removing Fuel High-Pressure Hose Stopper
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Pull up the retainer and remove the fuel high-pressure hose in the direction shown.

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

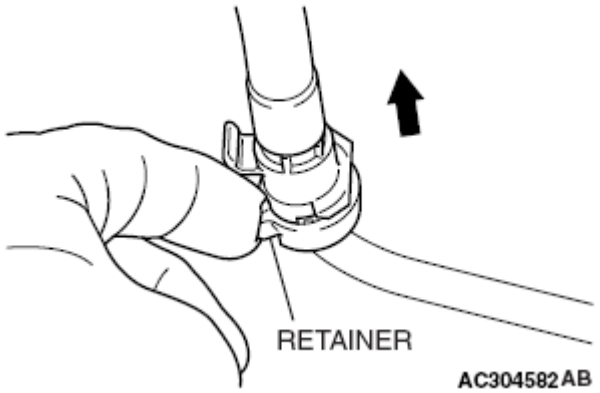


Fig. 24: Pulling Up Retainer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<F>> TRANSAXLE ASSEMBLY REMOVAL

1. Secure the A/C condenser and front end structure bar with a cord in a location where it does not interfere with engine assembly removal.

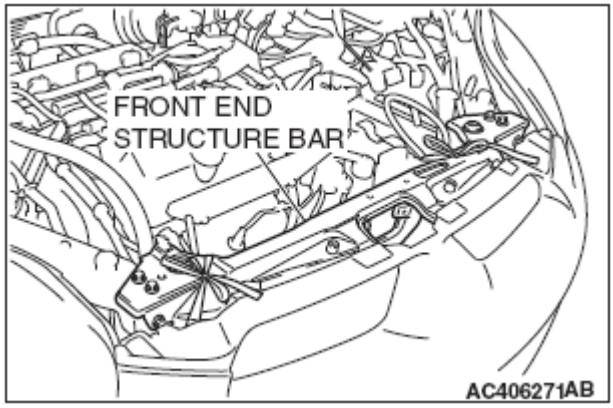


Fig. 25: Identifying Front End Structure Bar
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: M/T: Do not remove the flywheel bolt. If this bolt is removed, the flywheel assembly will become out of balance and damaged.

2. Remove the transaxle assembly. (M/T: Refer to **TRANSAXLE ASSEMBLY** , A/T: Refer to **TRANSAXLE ASSEMBLY**).

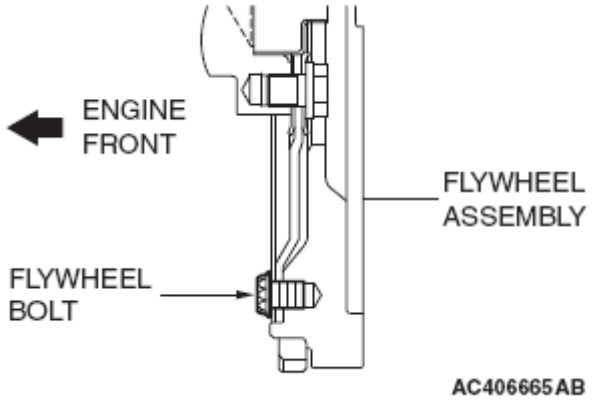


Fig. 26: Identifying Flywheel Bolt And Flywheel Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<G>> POWER STEERING OIL RESERVOIR REMOVAL

1. With the hose installed, remove the power steering oil reservoir from the vehicle. (Refer to **POWER STEERING HOSES**).
2. After removing the power steering oil reservoir, secure it with a cord in a location where it does not interfere with engine front mounting bracket removal.

<<H>> ENGINE FRONT MOUNTING BRACKET REMOVAL

1. Support the engine with a garage jack.
2. Remove the following special tool.
    1. <Special tool MB991895 is used>

       Remove special tool MB991895.

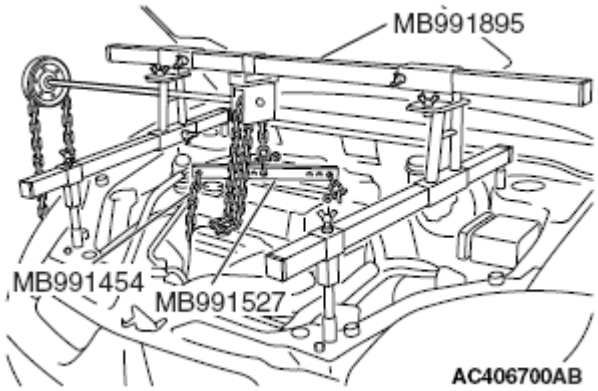


Fig. 27: Supporting Engine With Garage Jack Using Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

    2. <Special tool MB991928 is used>

Remove special tool MB991928.

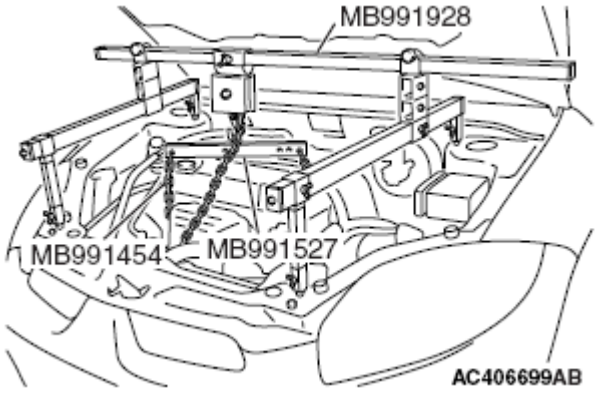


Fig. 28: Supporting Engine With Garage Jack Using Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Hold the engine assembly with a chain block, etc.
4. Place a garage jack against the engine oil pan with a piece of wood in between so that the weight of the engine assembly is no longer being applied to the engine front mounting bracket.
5. Loosen the engine front mounting bracket mounting nuts and bolts, and remove the engine front mounting bracket.

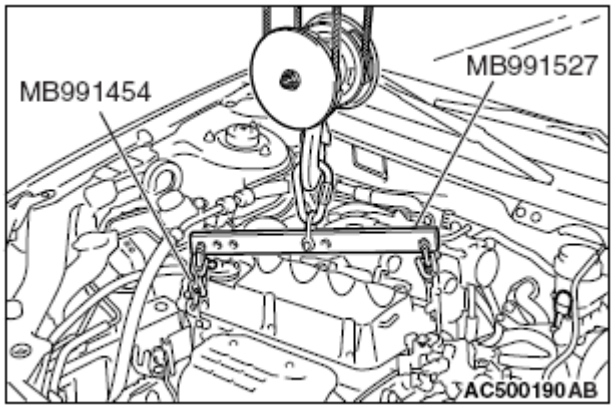


Fig. 29: Holding Engine Assembly With Chain Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<I>> ENGINE ASSEMBLY REMOVAL

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

INSTALLATION SERVICE POINTS

>>A<< ENGINE ASSEMBLY INSTALLATION

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

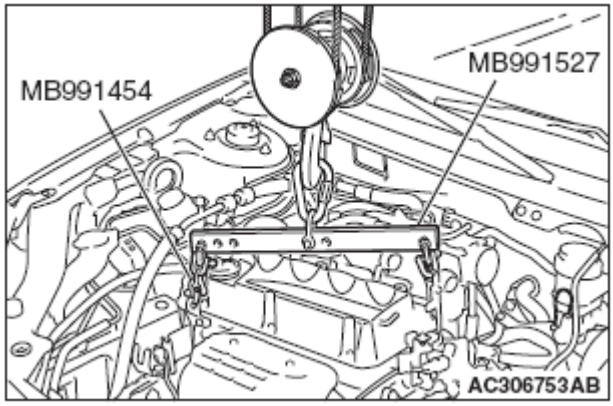


Fig. 30: Holding Engine Assembly With Chain Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< ENGINE FRONT MOUNTING BRACKET INSTALLATION

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine front mounting bracket while adjusting the position of the engine.
2. Support the engine assembly with a garage jack.
3. Remove the chain block.
4. Use the following special tool as during removal to support the engine.
    1. <Special tool MB991895 is used>

       Set special tool MB991895. (M/T: Refer to **TRANSAXLE ASSEMBLY** , A/T: Refer to **TRANSAXLE ASSEMBLY**).

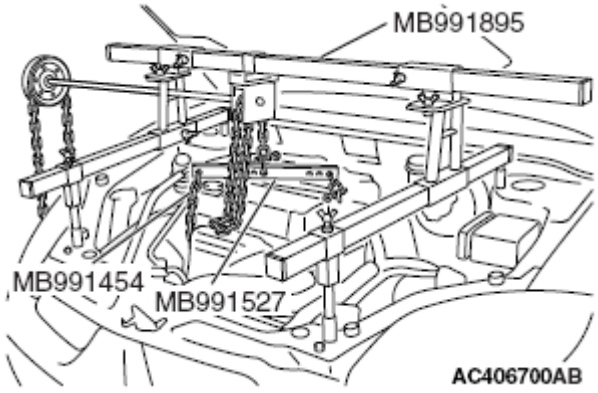


Fig. 31: Supporting Engine With Garage Jack Using Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

    2. <Special tool MB991928 is used>

Set special tool MB991928. (M/T: Refer to **TRANSAXLE ASSEMBLY** , A/T: Refer to **TRANSAXLE ASSEMBLY**).

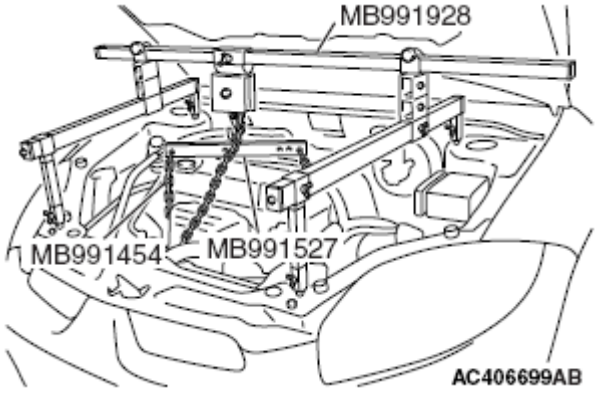


Fig. 32: Supporting Engine With Garage Jack Using Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<<TRANSAXLE ASSEMBLY INSTALLATION

1. Install the transaxle assembly. (M/T: Refer to **TRANSAXLE ASSEMBLY** , A/T: Refer to **TRANSAXLE ASSEMBLY**).
2. Remove the cord securing the A/C condenser and the front end structure bar

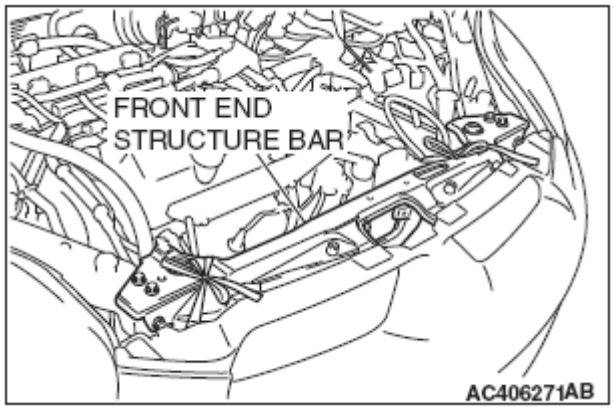


Fig. 33: Identifying Front End Structure Bar
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< FUEL HIGH-PRESSURE HOSE CONNECTION

CAUTION: After connecting the fuel high-pressure hose, slightly pull it to ensure that it is installed securely. Also confirm that there is a play of approximately 3 mm (0.12 inch). Then install the stopper securely.

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

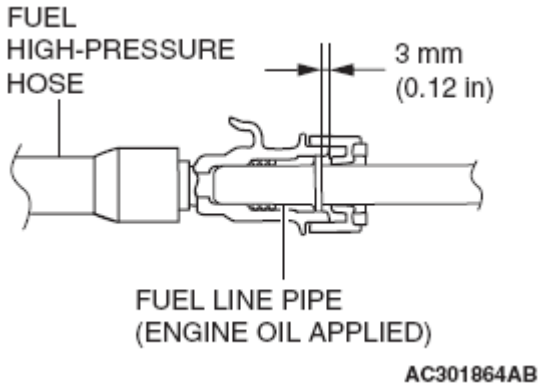


Fig. 34: Identifying Fuel Line Pipe Clearance
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

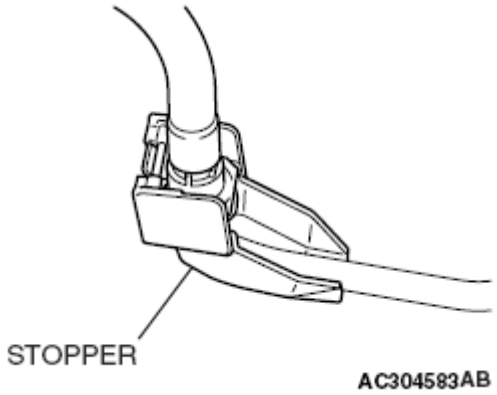


Fig. 35: Identifying Stopper
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< DRIVE BELT INSTALLATION

CAUTION:
- **To reuse the drive belt, install it while aligning the arrow mark on the backside of belt marked at the removal with the rotating direction.**
- **Check if there is no deviation of the drive belt at the notched pulley.**
- **Check if the drive belt is installed onto the center of the flat face of the flat pulley.**

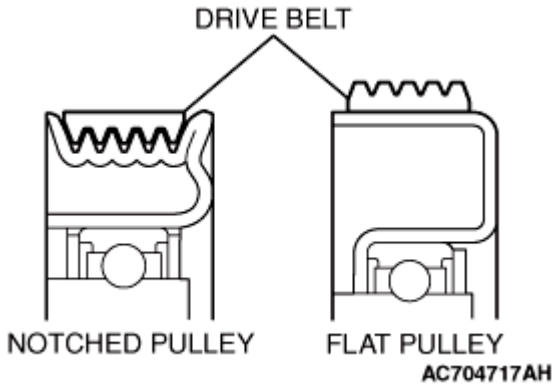


Fig. 36: Identifying Drive Belt Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

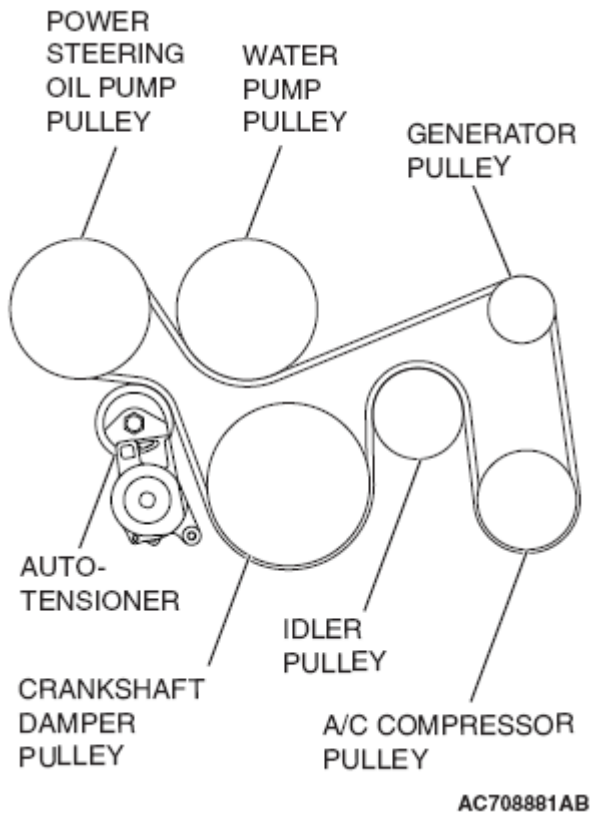


Fig. 37: View Of Drive Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< BRAKE BOOSTER VACUUM HOSE CONNECTION

Insert vacuum hose with its paint mark facing upward.

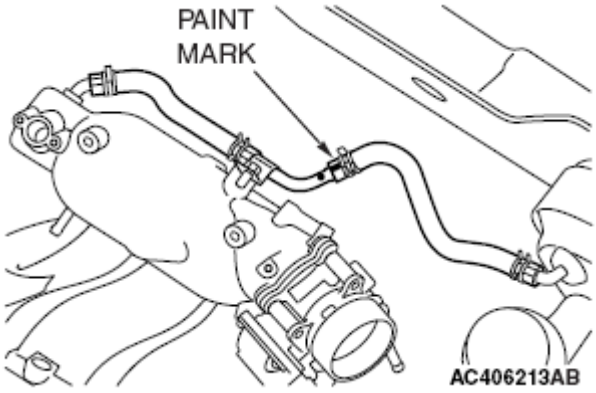
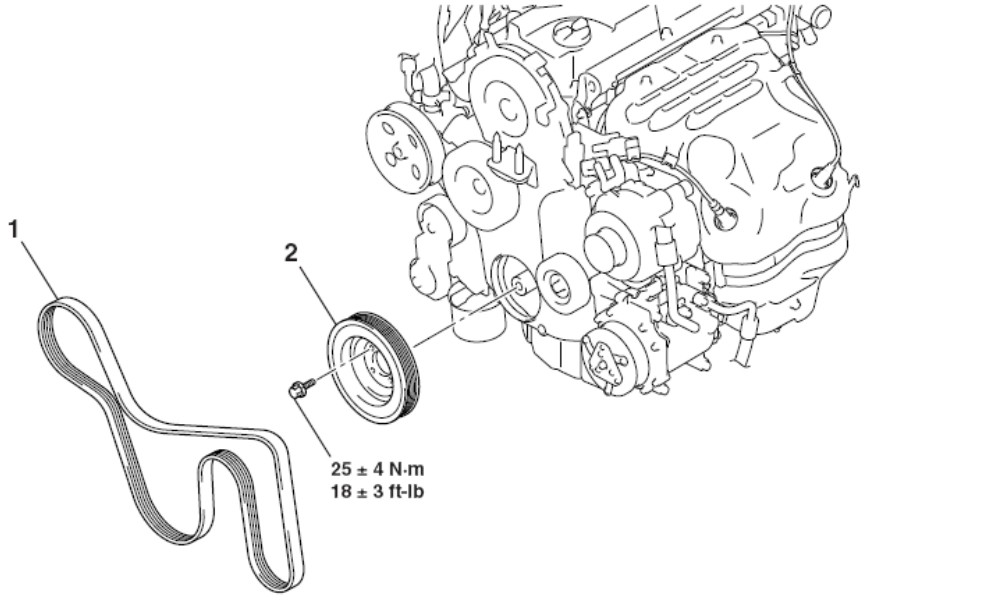


Fig. 38: Identifying Vacuum Hose Paint Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

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: Removal/Installation Of Crankshaft Damper Pulley And Drive Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

REMOVAL SERVICE POINT

<<A>> DRIVE BELT REMOVAL

The following operations are required due to the serpentine drive system with the drive belt auto-tensioner.

1. Securely insert the spindle handle or ratchet handle at a 12.7 mm (1/2-inch) angle into the jig hole of the auto-tensioner.
2. Rotate the auto-tensioner counterclockwise and align hole A with hole B.

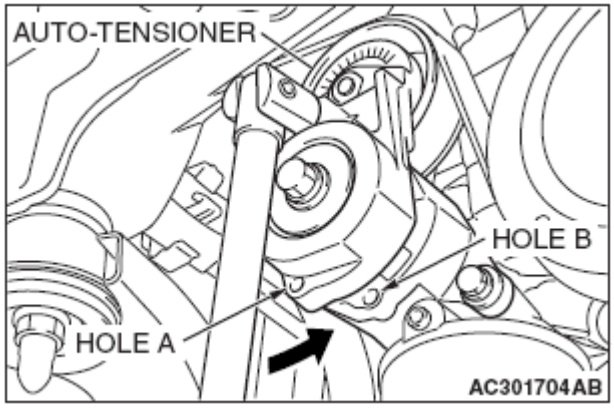


Fig. 40: Rotating Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: To reuse the drive belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

3. Insert an L-shaped hexagon wrench, etc. into the hole to secure its position, and then remove the drive belt.

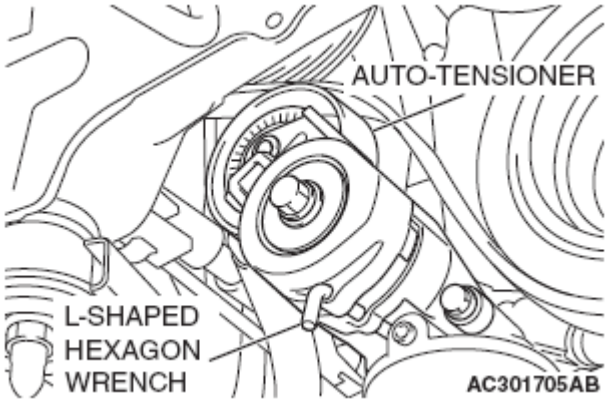


Fig. 41: Securing Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINT

>>A<< DRIVE BELT INSTALLATION

CAUTION:

- **To reuse the drive belt, install it while aligning the arrow mark on the backside of belt marked at the removal with the rotating direction.**
- **Check if there is no deviation of the drive belt at the notched pulley.**
- **Check if the drive belt is installed onto the center of the flat face of the flat pulley.**

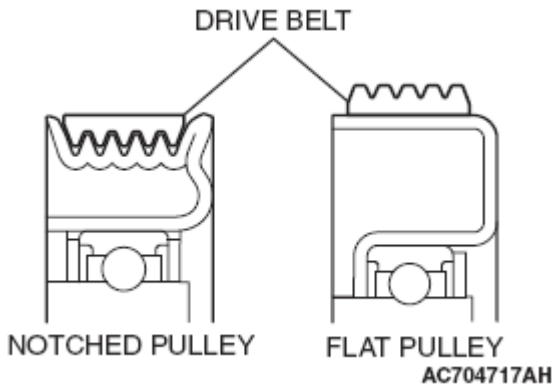


Fig. 42: Identifying Drive Belt Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

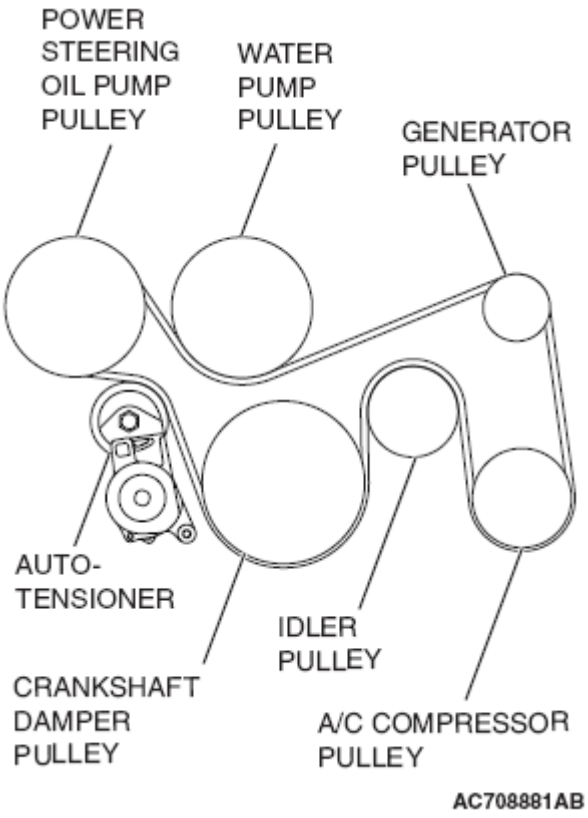


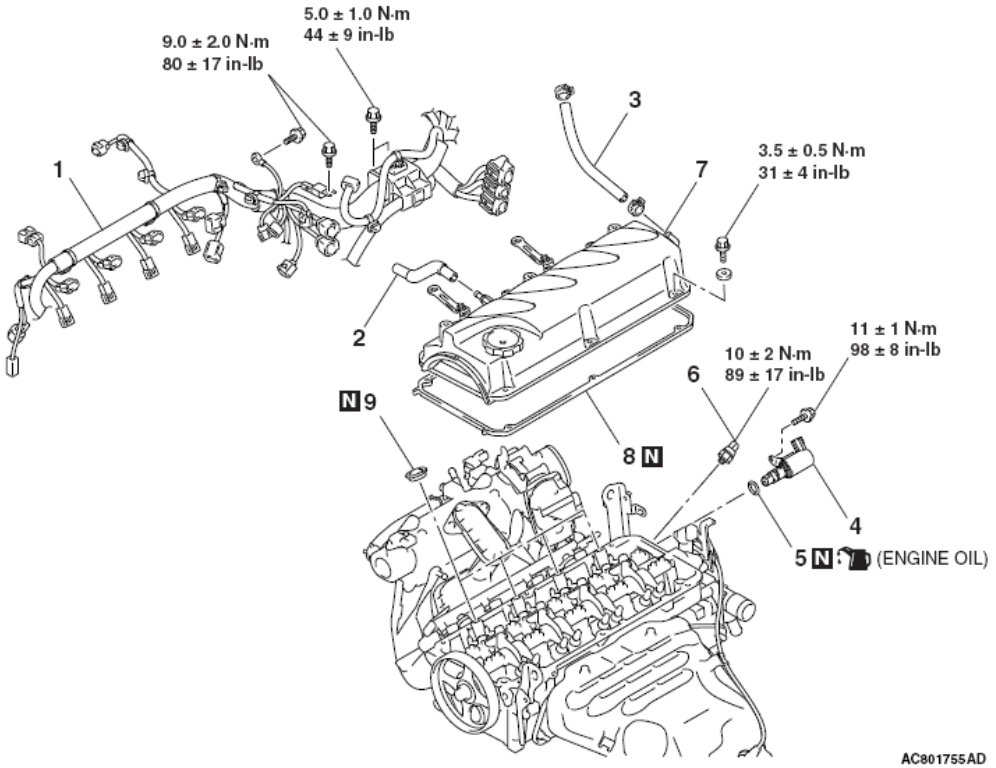
Fig. 43: View Of Drive Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAMSHAFT AND VALVE STEM SEAL

REMOVAL AND INSTALLATION

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

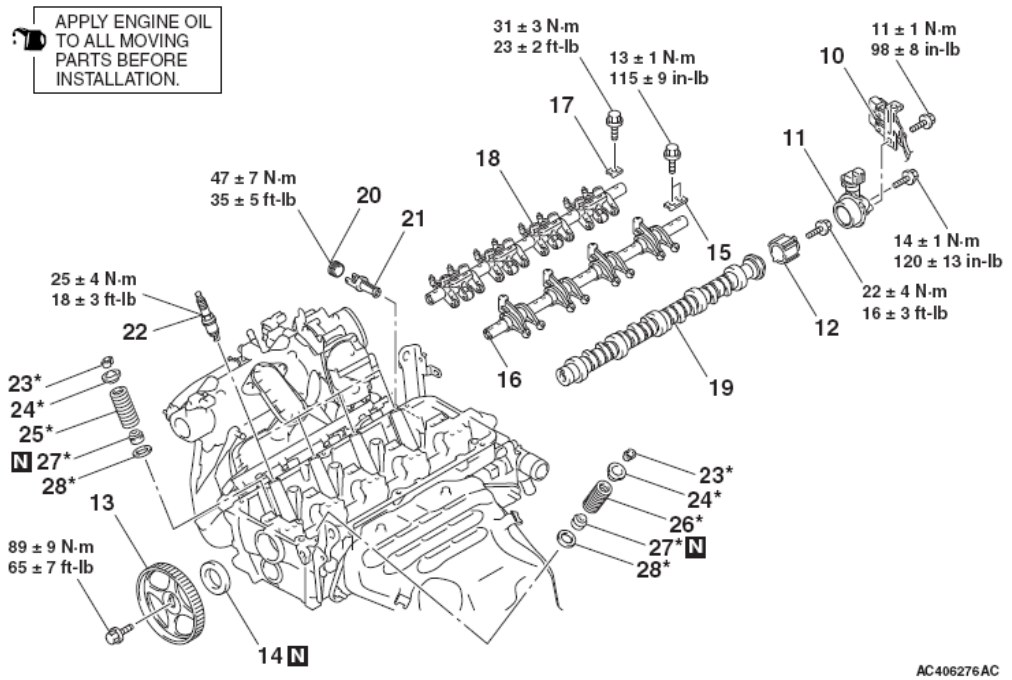
Pre-removal Operation	Post-installation Operation
• ECM <M/T> or PCM <A/T> Removal • Air Cleaner Removal • Battery and Battery Tray Removal • Ignition Coils Removal • Timing Belt Upper Cover Removal	• Timing Belt Upper Cover Installation • Ignition Coils Installation • Battery and Battery Tray Installation • 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: Removal/Installation Of Camshaft And Valve Stem Seal Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



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: Removal/Installation Of Camshaft And Valve Stem Seal Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB991999: Valve Stem Seal Installer
- MD998713: Camshaft Oil Seal Installer
- MD998719: Pin
- MD998772: Valve Spring Compressor

REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET REMOVAL

1. Hold the camshaft sprocket with special tools MB990767 and MD998719.
2. Loosen the camshaft sprocket mounting bolt and remove the camshaft sprocket.

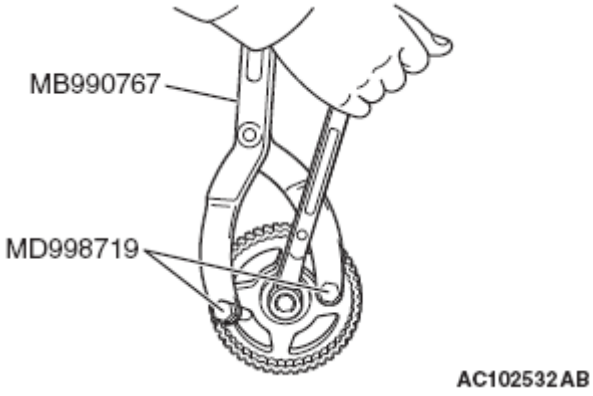


Fig. 46: Removing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> EXHAUST ROCKER ARM AND SHAFT ASSEMBLY/INTAKE ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

CAUTION: Never disassemble the exhaust rocker arm and shaft assembly, and intake rocker arm and shaft assembly.

<<C>> CAMSHAFT REMOVAL

1. Raise the transaxle assembly until the camshaft and transaxle mounting body side bracket do not touch it.
2. Remove the camshaft.

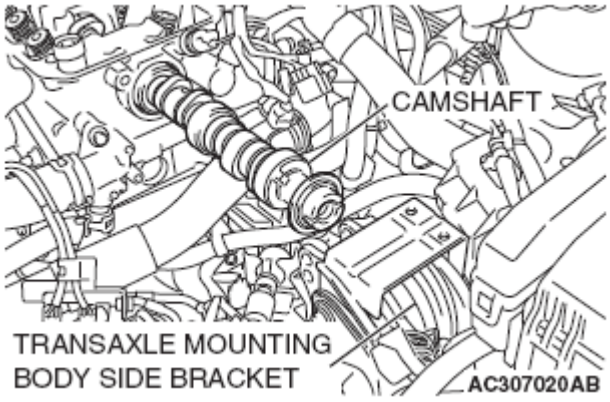


Fig. 47: Removal Camshaft And Transaxle Mounting Body Side Bracket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<D>> VALVE SPRING RETAINER LOCKS REMOVAL

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

Use special tool MD998772 to compress the valve spring and then remove the valve spring retainer locks.

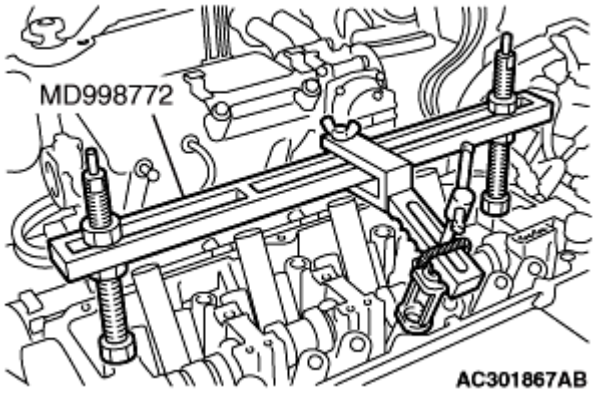


Fig. 48: Compressing Valve Spring
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< VALVE STEM SEALS INSTALLATION

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

CAUTION:
- **Do not re-use the valve stem seal.**
- **The special tool MB991999 must be used to install the valve stem seal. Improper installation could result in oil leaking past**

the valve guide.

2. Use special tool MB991999 to fill a new valve stem seal in the valve guide using the valve stem area as a guide.

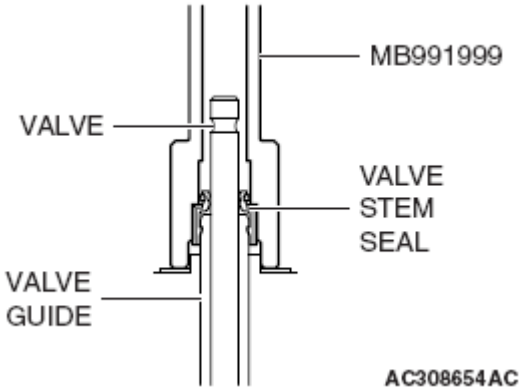


Fig. 49: Installing Valve Stem Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< EXHAUST VALVE SPRINGS/INTAKE VALVE SPRINGS INSTALLATION

Install the valve springs with the identification color painted end facing the rocker arm.

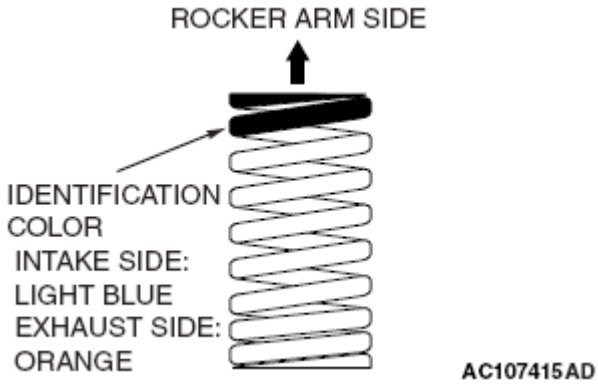


Fig. 50: Identifying Valve Spring Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< VALVE SPRING RETAINER LOCKS INSTALLATION

Use special tool MD998772 to compress the valve spring and then install the valve spring retainer lock in the same manner as removal.

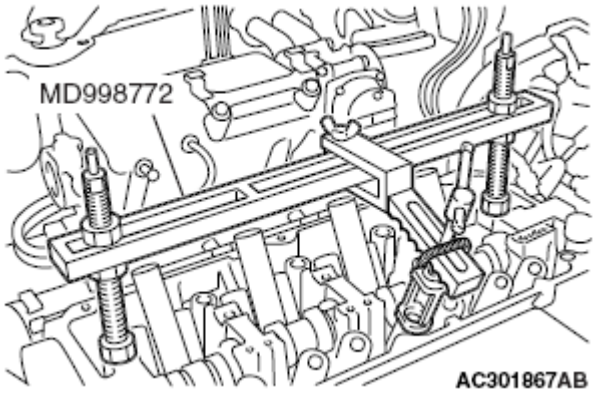


Fig. 51: Compressing Valve Spring
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< CAMSHAFT INSTALLATION

Set the dowel pin of the camshaft in the position shown in the figure.

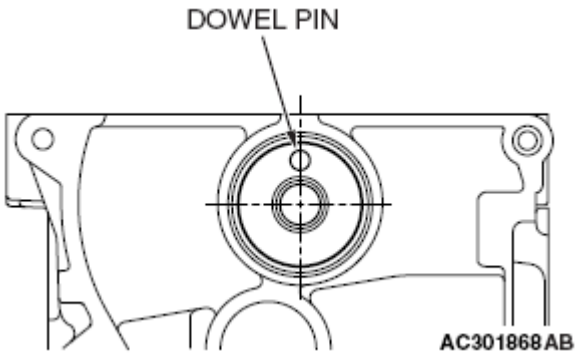


Fig. 52: Identifying Dowel Pin Of Camshaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< INTAKE ROCKER ARM AND SHAFT ASSEMBLY/INTAKE ROCKER ARM SHAFT CAPS INSTALLATION

1. Place the intake rocker shaft so that its 5.5 mm (0.22 inch) diameter hole faces toward the cylinder head.
2. Install the intake rocker arm shaft caps.
3. Tighten the intake rocker shaft mounting bolts to the specified torque.

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

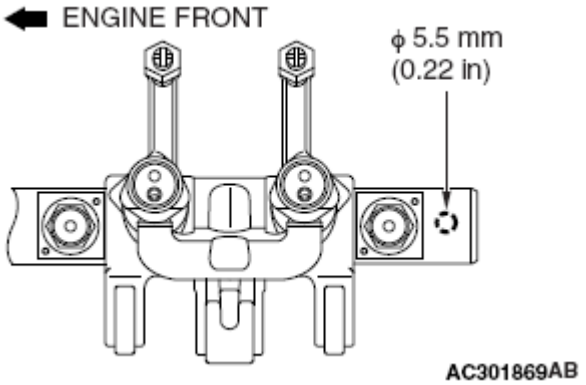


Fig. 53: Intake Rocker Arm And Shaft Assembly Installation Direction
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< EXHAUST ROCKER ARM AND SHAFT ASSEMBLY/EXHAUST ROCKER ARM SHAFT CAPS INSTALLATION

1. Install the exhaust rocker shaft so that its notch is positioned as shown.
2. Install the exhaust rocker arm shaft caps.
3. Tighten the exhaust rocker shaft mounting bolts to the specified torque.

Tightening torque: 13 ± 1 N.m (115 ± 9 in-lb)

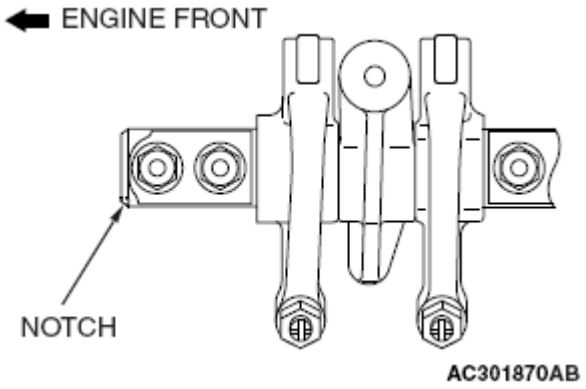


Fig. 54: Exhaust Rocker Arm And Shaft Assembly Installation Direction
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>G<< CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the entire inner diameter of the oil seal lip.
2. Use special tool MD998713 to press-fit the oil seal as shown.

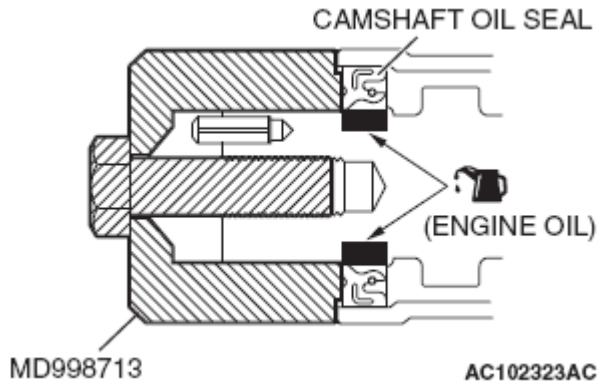


Fig. 55: Camshaft Oil Seal Engine Oil Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>H<< CAMSHAFT SPROCKET INSTALLATION

1. Hold the camshaft sprocket with special tools MB990767 and MD998719 in the same manner as removal.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 89 ± 9 N.m (65 ± 7 ft-lb)

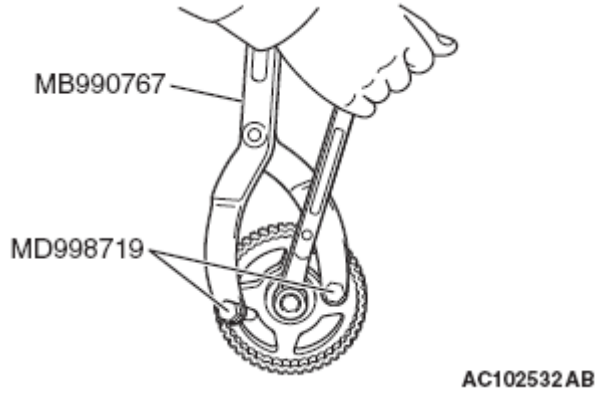


Fig. 56: Installing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>I<< CAMSHAFT POSITION SENSOR SUPPORT INSTALLATION

1. Remove old sealant from the camshaft position sensor support and cylinder head surfaces.
2. Apply sealant to the camshaft position sensor support flange in a continuous bead as shown in the illustration.

Specified sealant: 3M™ AAD Part No. 8672, 3M™ AAD Part No. 8679/8678 or equivalent

NOTE: Install the camshaft position sensor support immediately after applying sealant.

3. Install the camshaft position sensor support to the cylinder head.

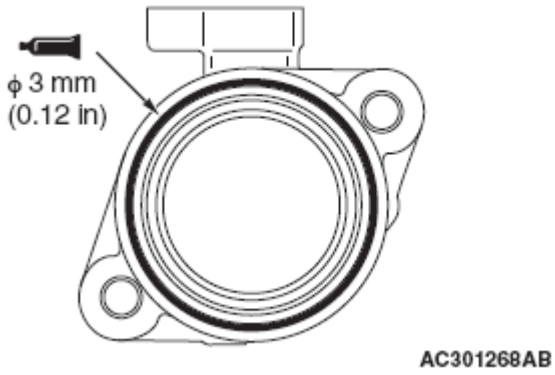


Fig. 57: Camshaft Position Sensor Support Flange Sealant Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: After installing the parts, wait at least one hour. Never start the engine or let engine oil or water touch the sealant application area during that time.

4. Tighten the camshaft position sensor support mounting bolts to the specified torque.

Tightening torque: 14 ± 1 N.m (120 ± 13 in-lb)

>>J<< ENGINE OIL PRESSURE SWITCH INSTALLATION

1. Remove old sealant from the engine oil pressure switch and cylinder head surfaces.
2. Apply sealant to the thread of the engine oil pressure switch as shown.

Specified sealant: 3M™ AAD Part No. 8672, 3M™ AAD Part No. 8679/8678 or equivalent

NOTE: Install the engine oil pressure switch immediately after applying sealant.

3. Install the engine oil pressure switch to the cylinder head.

CAUTION: After installing the parts, wait at least one hour. Never start the engine or let engine oil or water touch the sealant application area during that time.

4. Tighten the engine oil pressure switch to the specified torque as shown.

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

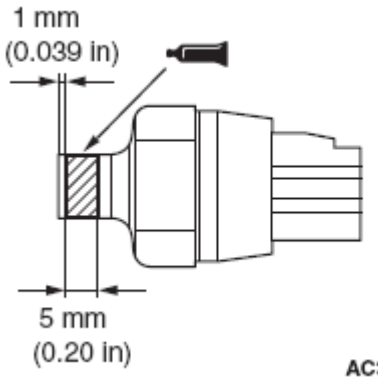


Fig. 58: Engine Oil Pressure Switch Sealant Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

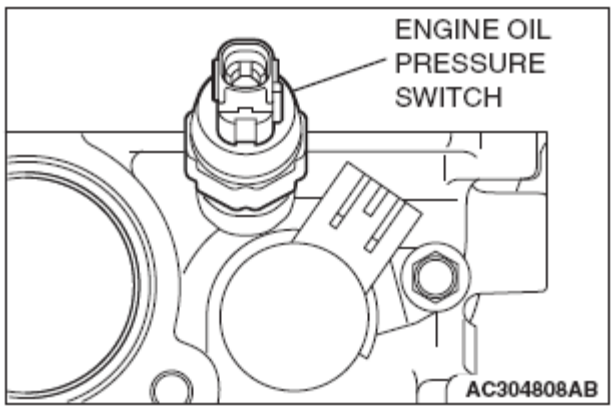


Fig. 59: Identifying Engine Oil Pressure Switch
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

Tightening torque: 11 ± 1 N.m (98 ± 8 in-lb)

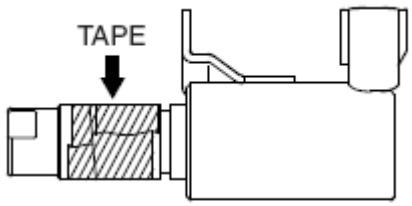
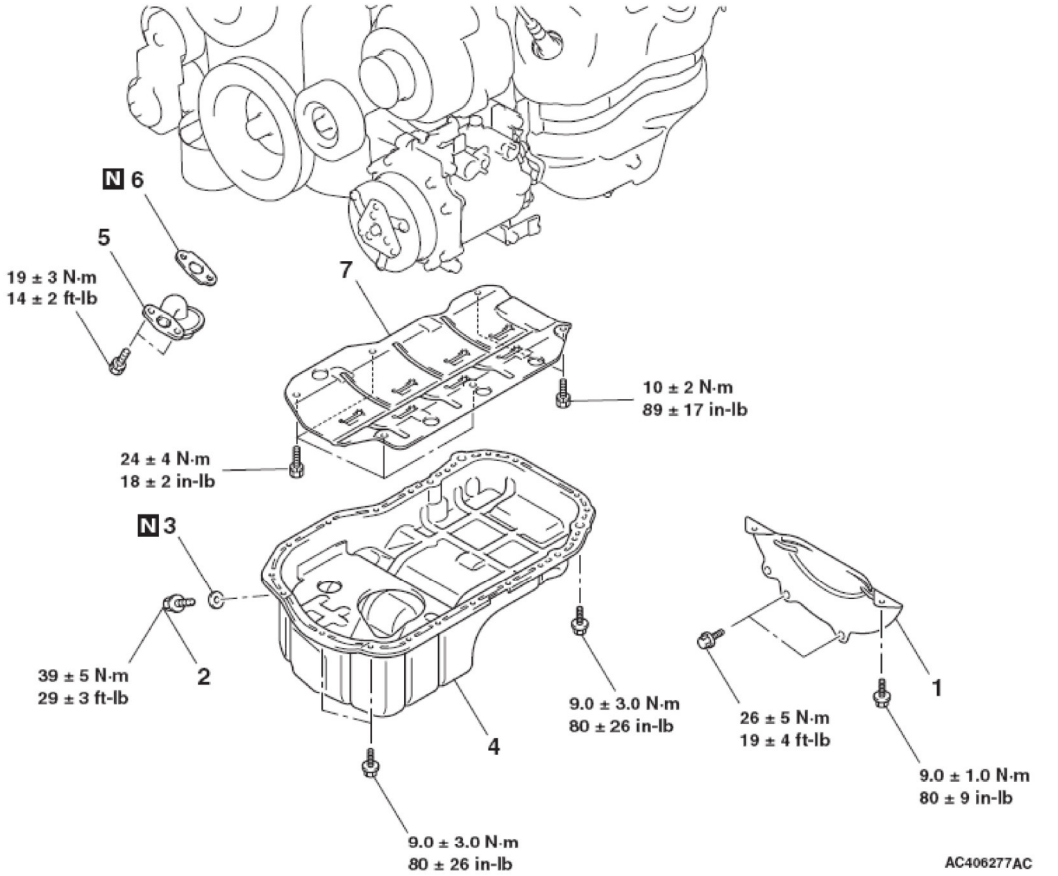


Fig. 60: Winding Sealing Tape Around Oil Passages Cut-Out Area Of Engine Oil Control Valve
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

OIL PAN

REMOVAL AND INSTALLATION

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: Removal/Installation Of Oil Pan Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MD998727: Oil Pan FIPG cutter

REMOVAL SERVICE POINT

<<A>> ENGINE OIL PAN REMOVAL

1. Remove the engine oil pan mounting bolts.

CAUTION: Do not use special tool MD998727 in area A of the engine oil pan. Using the special tool in area A may cause deformation of the front case because the front case is made of aluminum.

2. Tap special tool MD998727 into the range (B) between the cylinder block and the engine oil pan, and then slide the tool sideways.

NOTE: If any sounding parts interfere with the removal, there is no need to use special tool MD998727.

3. Remove the engine oil pan.

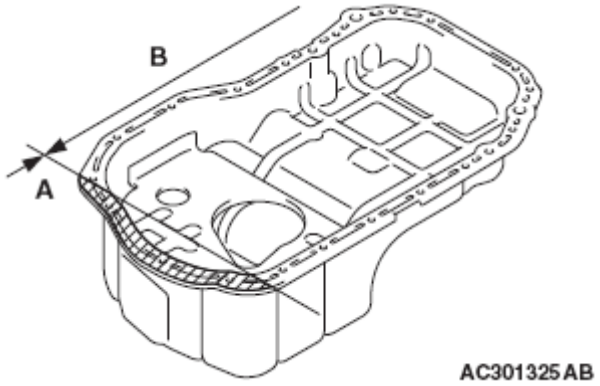


Fig. 62: Identifying Special Tool Tapping Range Between Cylinder Block And Engine Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

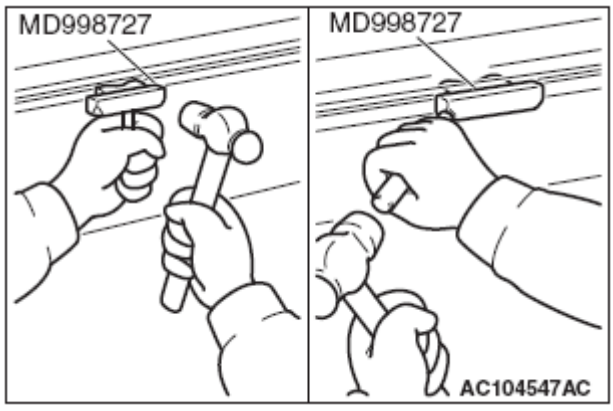


Fig. 63: Removing Engine Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< ENGINE OIL PAN INSTALLATION

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

Specified sealant: 3M™ AAD Part No. 8672, 8704, 3M™ AAD Part No. 8679/8678 or equivalent

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

3. Install the engine oil pan to the cylinder block.

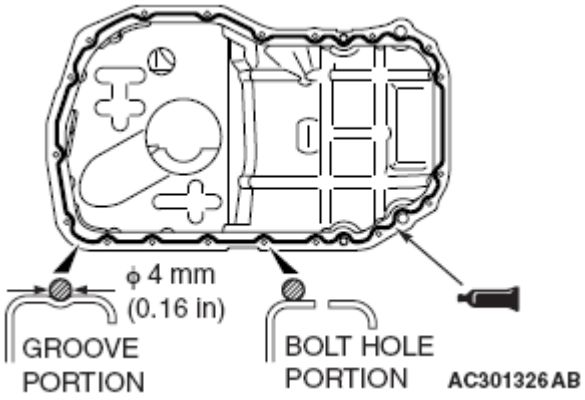


Fig. 64: Applying Sealent To Mating Surface Of Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: After installing the parts, wait at least one hour. Never start the engine or let engine oil or water touch the sealant application area during that time.

4. Tighten the engine oil pan mounting bolts to the specified torque. Be careful when installing, as the bolts indicated in the illustration have different lengths from the other bolts.

Tightening torque: 9.0 ± 3.0 N.m (80 ± 26 in-lb)

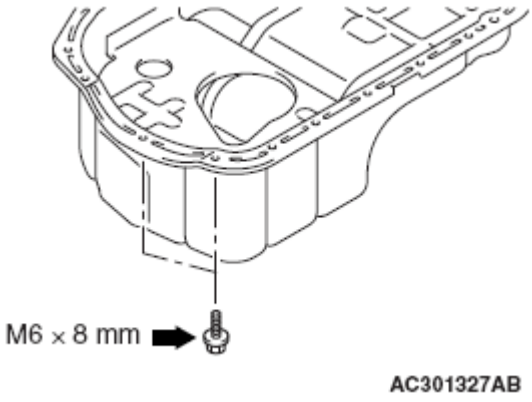
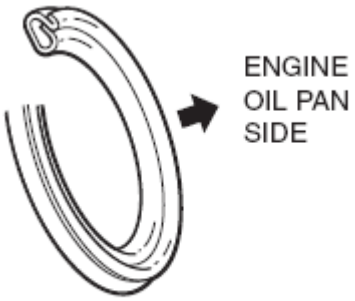


Fig. 65: Locating Engine Oil Pan Mounting Bolt

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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



AC102325 AE

Fig. 66: Engine Oil Pan Drain Plug Gasket Installation Direction
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

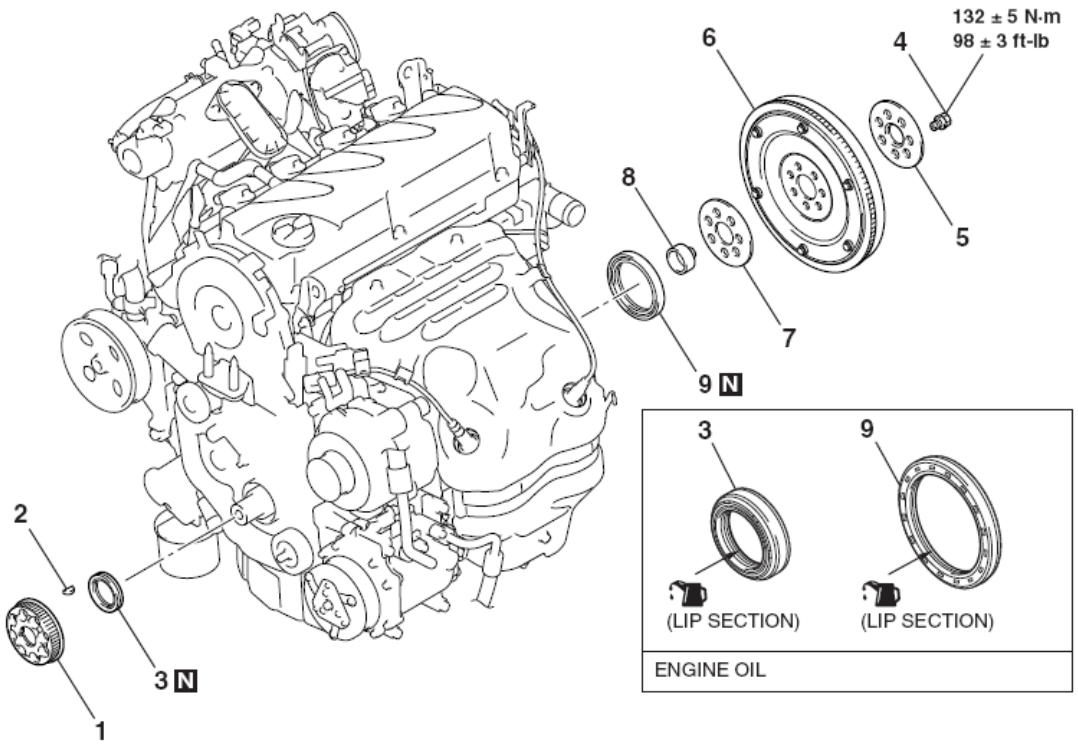
INSPECTION

- Check the oil pan for cracks.
- Check the oil pan sealant-coated surface for damage and deformation.

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

<M/T>



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

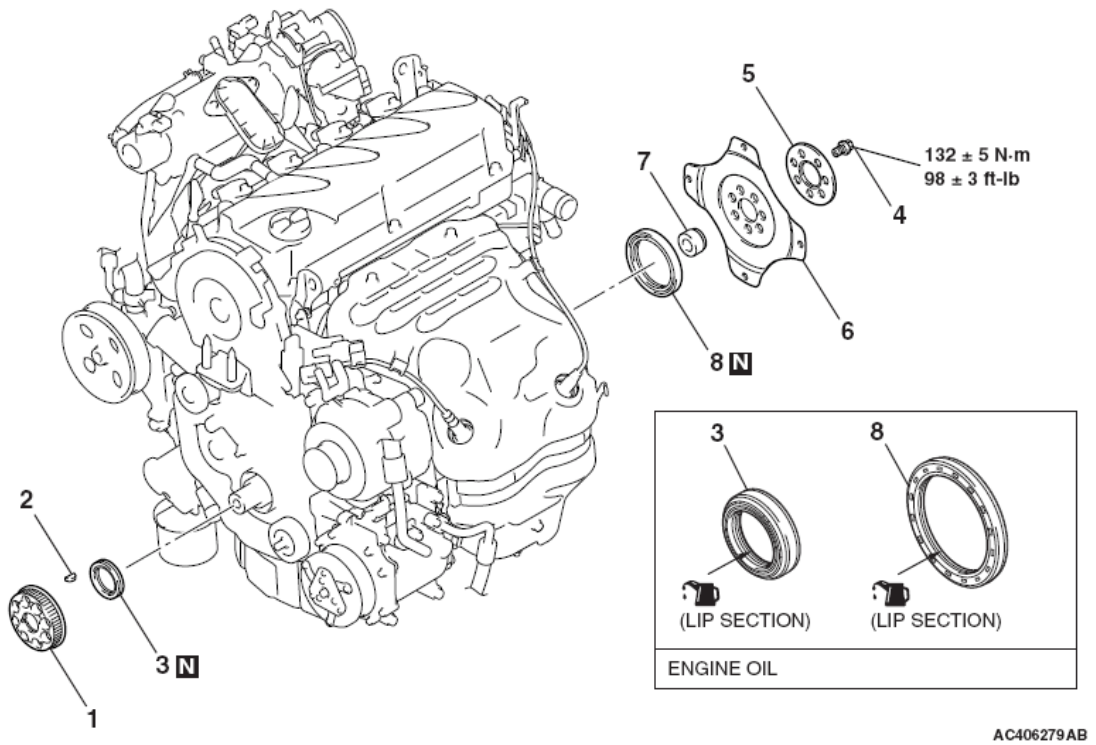
- TRANSAXLE ASSEMBLY
- CLUTCH COVER AND CLUTCH DISC
- >>B<< 4. FLYWHEEL BOLTS
- 5. FLYWHEEL ADAPTER PLATE
- 6. FLYWHEEL ASSEMBLY
- 7. FLYWHEEL ADAPTER PLATE
- 8. CRANKSHAFT BUSHING
- >>A<< 9. CRANKSHAFT REAR OIL SEAL

Fig. 67: Removal/Installation Of Crankshaft Oil Seal Components With Torque Specifications - M/T
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990938: Installer Bar
- MD998285: Crankshaft Front Oil Seal Guide
- MD998375: Crankshaft Front Oil Seal Installer
- MD998776: Crankshaft Rear Oil Seal Installer
- MD998781: Flywheel Stopper

<A/T>



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: Removal/Installation Of Crankshaft Oil Seal Components With Torque Specifications - A/T
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990938: Installer Bar
- MD998285: Crankshaft Front Oil Seal Guide
- MD998375: Crankshaft Front Oil Seal Installer
- MD998776: Crankshaft Rear Oil Seal Installer
- MD998781: Flywheel Stopper

REMOVAL SERVICE POINTS

<<A>> TRANSAXLE ASSEMBLY REMOVAL

CAUTION: Do not remove the flywheel bolt. If this bolt is removed, the flywheel assembly will become out of balance and damaged.

Refer to **TRANSAXLE ASSEMBLY** .

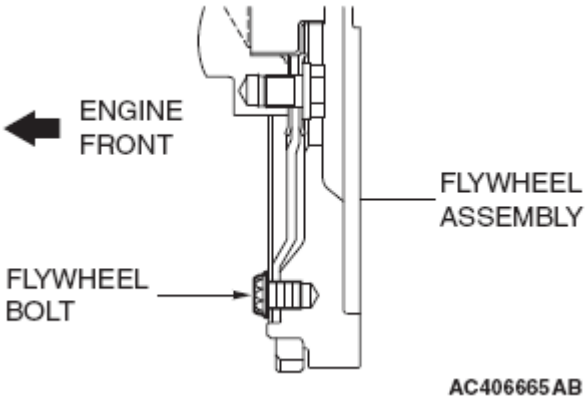


Fig. 69: Identifying Flywheel Bolt And Flywheel Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> FLYWHEEL BOLTS/A/T DRIVE PLATE BOLTS REMOVAL

1. Use special tool MD998781 to secure the flywheel assembly or A/T drive plate.
2. Remove the flywheel bolts or A/T drive plate bolts.

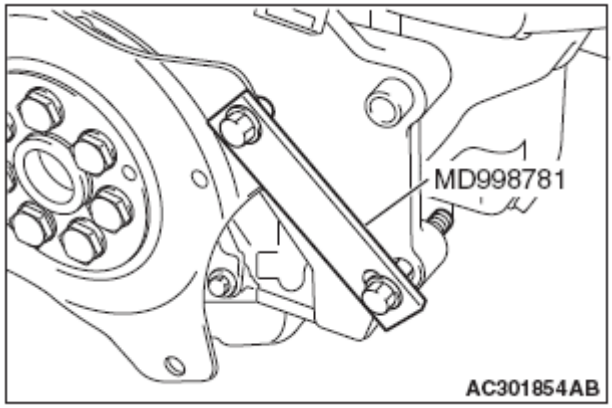


Fig. 70: Securing Flywheel Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire inner diameter of the oil seal lip.
2. Use special tools MB990938 and MD998776 to press-fit the oil seal.

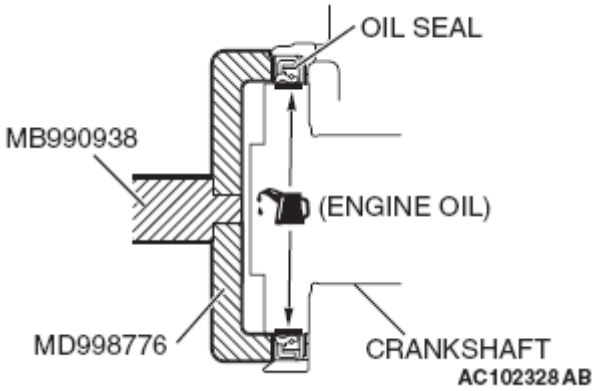


Fig. 71: Inner Diameter Of Crankshaft Rear Oil Seal Lip Engine Oil Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< FLYWHEEL BOLTS/A/T DRIVE PLATE BOLTS INSTALLATION

1. Use special tool MD998781 to secure the flywheel assembly or A/T drive plate in the same manner as removal.
2. Tighten the flywheel bolts or A/T drive plate bolts to the specified torque.

   Tightening torque: 132 ± 5 N.m (98 ± 3 ft-lb)

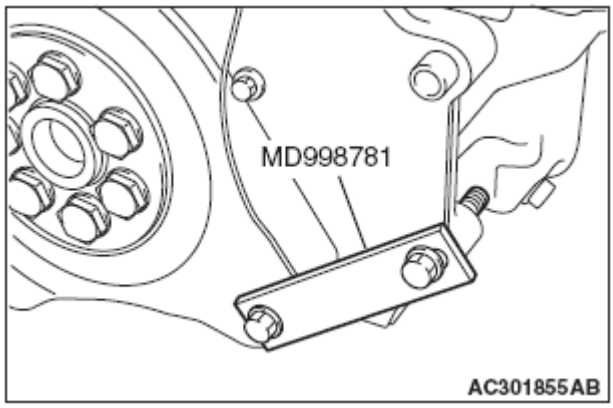


Fig. 72: Securing Flywheel Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the outer diameter of special tool MD998285 and install it to the crankshaft.
2. Apply a small amount of engine oil to the entire inner diameter of the oil seal lip.
3. Use special tool MD998375 to press-fit the oil seal.

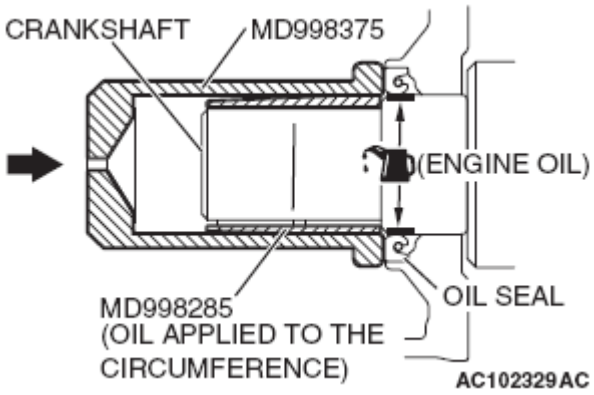


Fig. 73: Inner Diameter Of Crankshaft Front Oil Seal Lip Engine Oil Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< CRANKSHAFT BALANCER SHAFT DRIVE SPROCKET INSTALLATION

1. Clean or degrease the front case, the crankshaft and the crankshaft balancer shaft drive sprocket as shown.

NOTE: Also clean the degreased surfaces.

2. Install the crankshaft balancer shaft drive sprocket in the direction shown in the illustration.

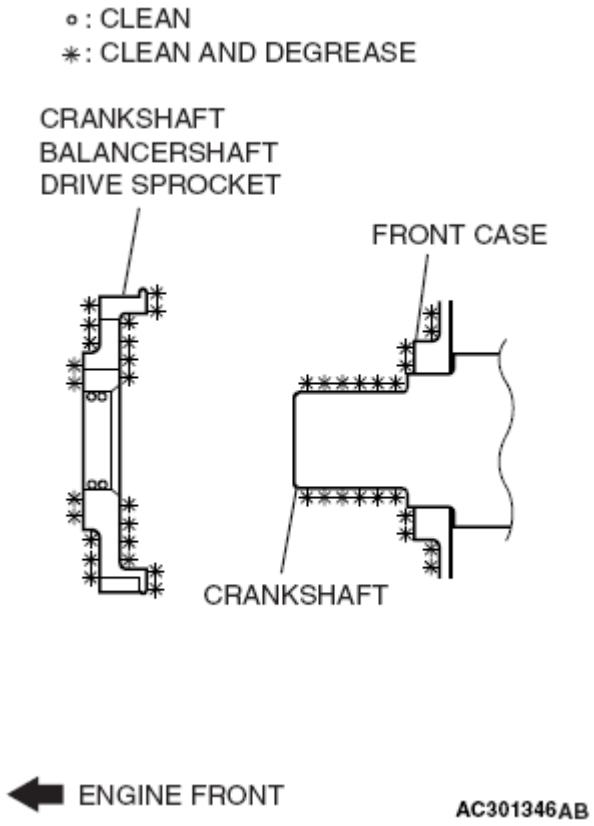


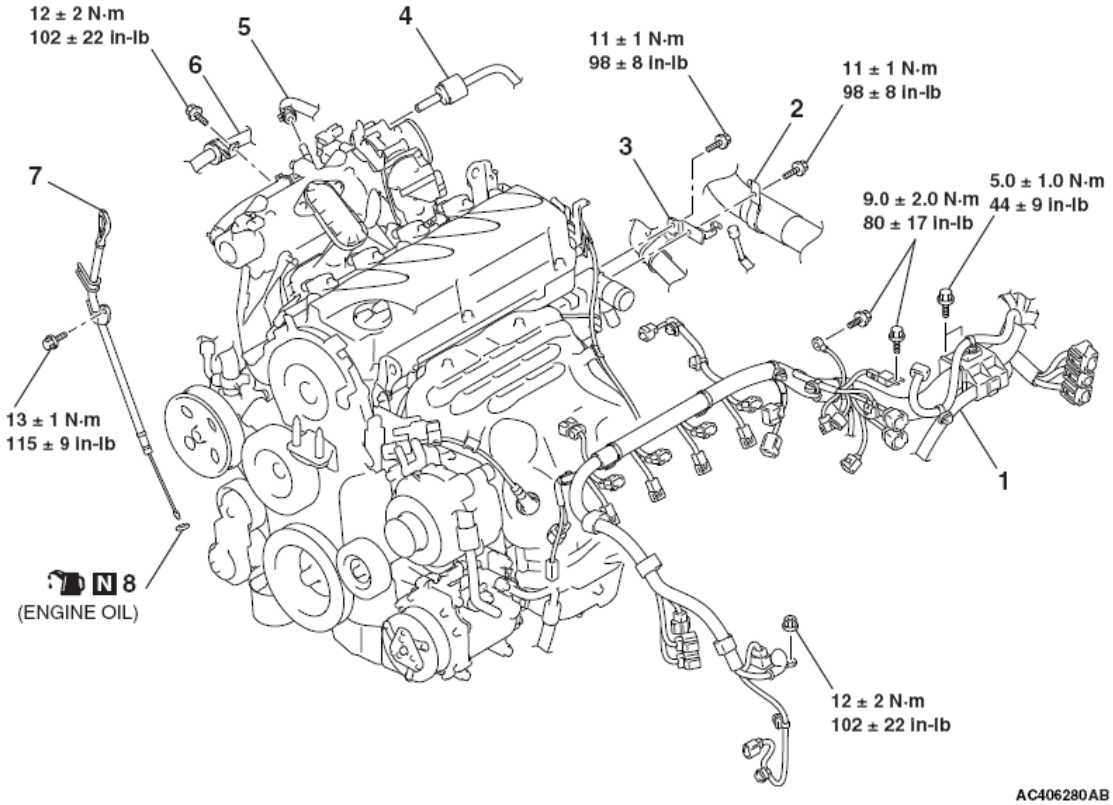
Fig. 74: Crankshaft Balancer Shaft Drive Sprocket Cleaning Area

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

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

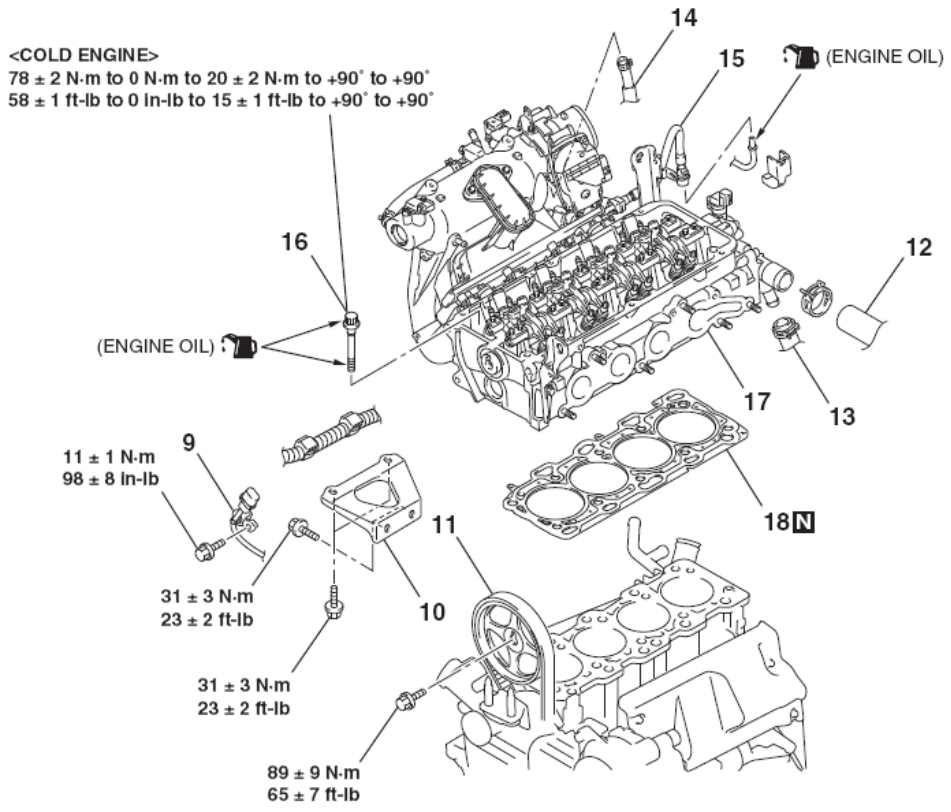


REMOVAL STEPS

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: Removal/Installation Of Cylinder Head Gasket Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



REMOVAL STEPS

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

Fig. 76: Removal/Installation Of Cylinder Head Gasket Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB991654: Cylinder Head Bolt Wrench (12)
- MD998719: Pin
- MD998738: Adjusting Bolt

REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET REMOVAL

CAUTION: Never turn the crankshaft counterclockwise.

1. Turn the crankshaft clockwise, align the timing marks on the camshaft sprocket to set number 1 cylinder to TDC of its compression stroke.

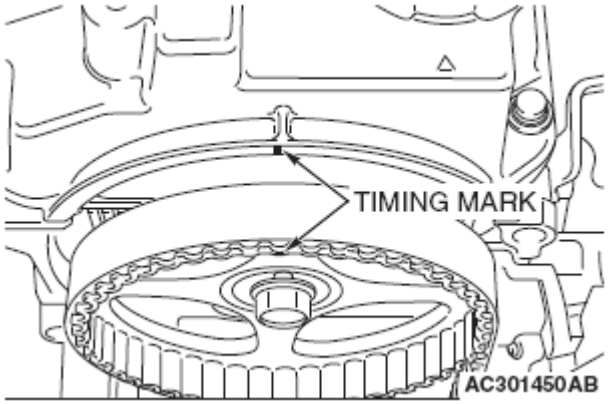


Fig. 77: Camshaft Sprocket Timing Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the timing belt under cover rubber plug and then set special tool MD998738.

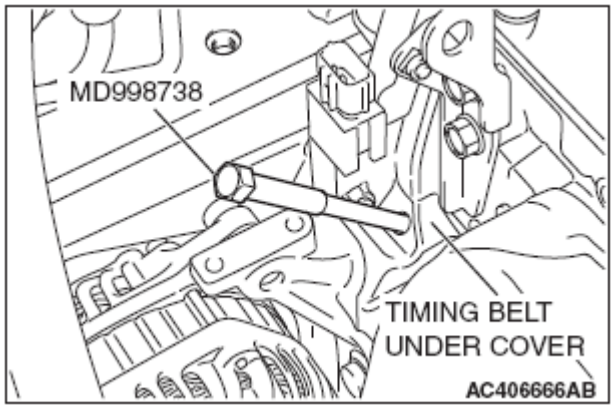


Fig. 78: Setting Special Tool MD998738
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Screw in special tool MD998738 until it contacts the timing belt tensioner arm.

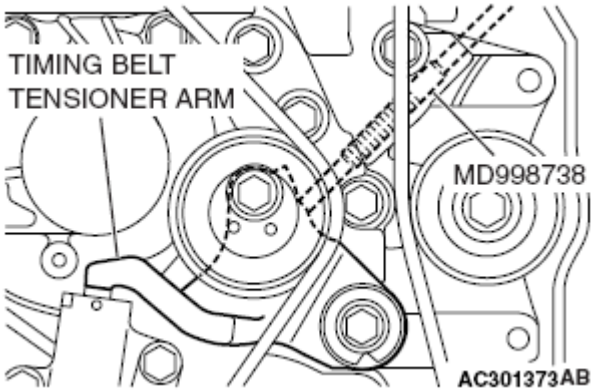


Fig. 79: Identifying Special Tool MD998738 Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Secure the camshaft sprocket and valve timing belt with wire to prevent slippage between the camshaft sprocket and valve timing belt.

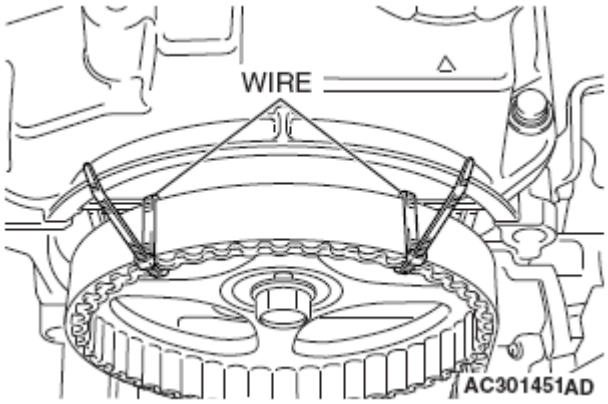


Fig. 80: Securing Camshaft Sprocket And Valve Timing Belt With Wire
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Hold the camshaft sprocket with special tools MB990767 and MD998719.

CAUTION: Do not rotate the crankshaft after camshaft sprocket removal.

6. Remove the camshaft sprocket with the valve timing belt and place it on the timing belt lower cover.

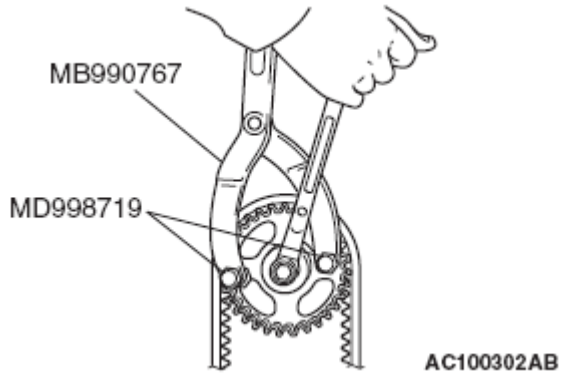


Fig. 81: Removing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> RADIATOR UPPER HOSE DISCONNECTION

Make mating marks on the radiator upper hose and the hose clamp. Disconnect the radiator upper hose.

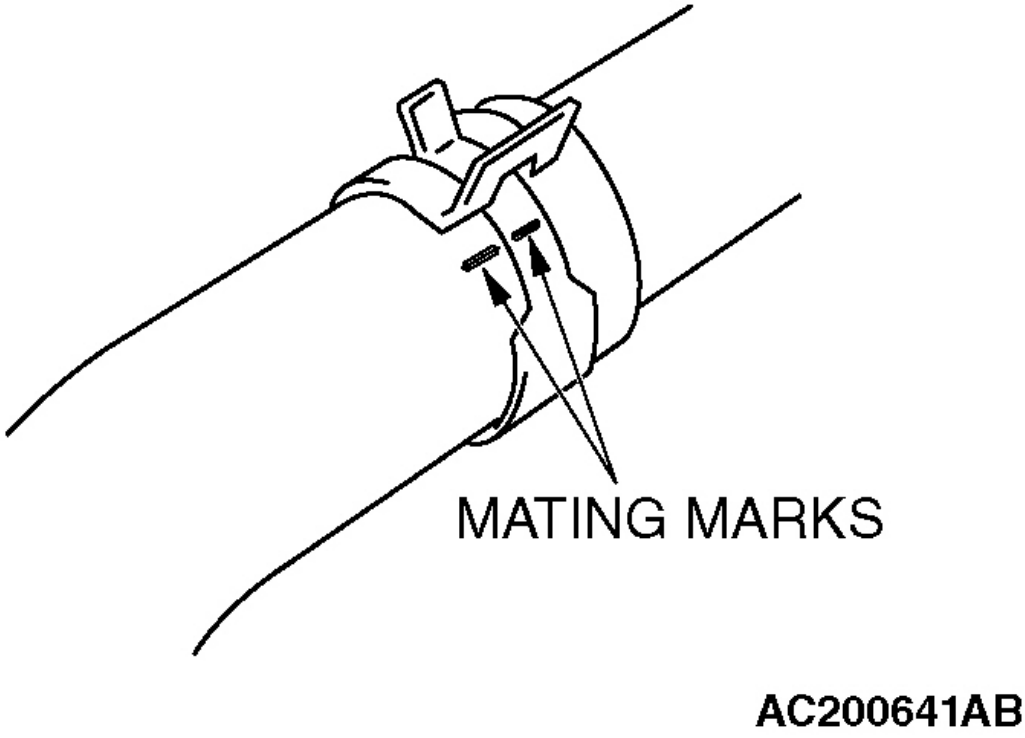


Fig. 82: Mating Marks On Radiator Upper Hose And Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<C>> FUEL HIGH-PRESSURE HOSE DISCONNECTION

1. Remove the fuel high-pressure hose stopper.

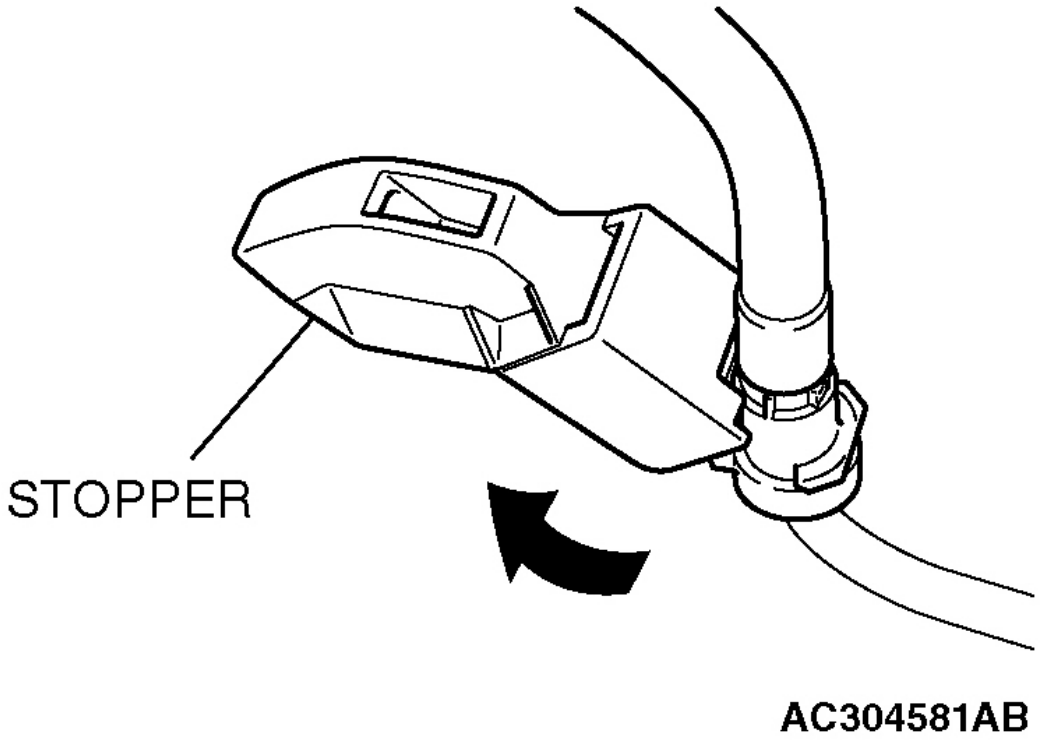


Fig. 83: Removing Fuel High-Pressure Hose Stopper
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Pull up the retainer and remove the fuel high-pressure hose in the direction shown.

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

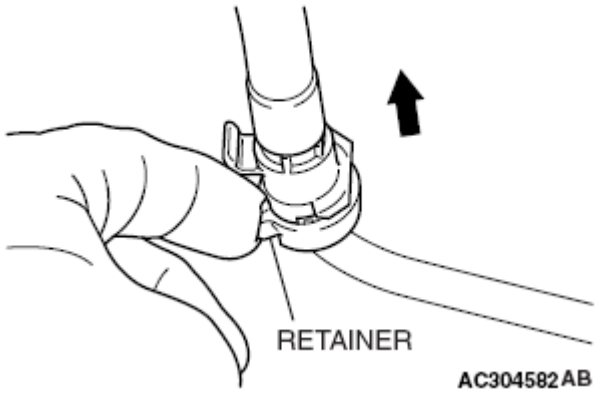


Fig. 84: Pulling Up Retainer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<D>> CYLINDER HEAD BOLTS REMOVAL

Use special tool MB991654 to loosen the cylinder head bolts in two or three steps in the order shown in the illustration. If the cylinder head bolts cannot be pulled out due to the washer being trapped in the valve spring, raise the bolt slightly, then remove it while holding it with a magnet.

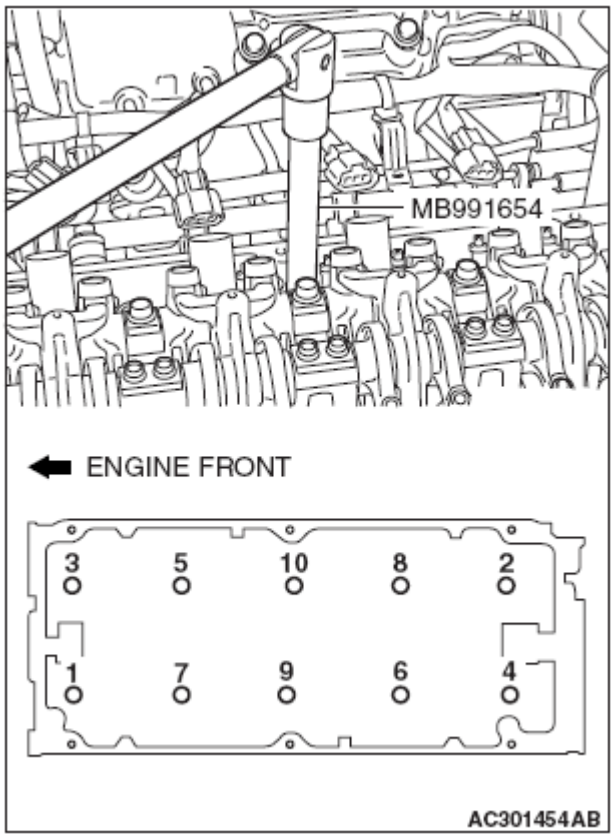


Fig. 85: Cylinder Head Bolts Removal Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< CYLINDER HEAD GASKET INSTALLATION

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

1. Degrease the cylinder head gasket mounting surface.
2. Assemble to the cylinder block so the cylinder head gasket identification mark of "381" is at the top surface and on the exhaust side.

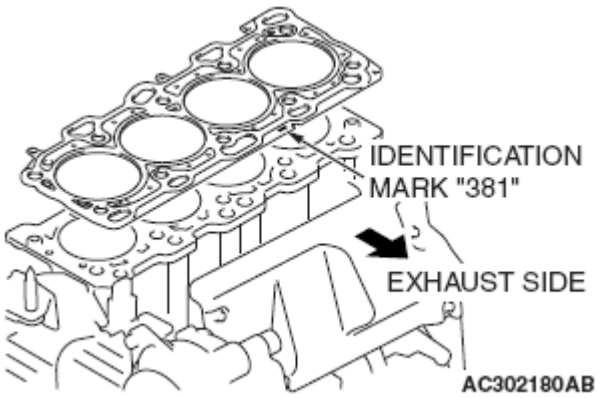


Fig. 86: Cylinder Head Gasket Installation Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< CYLINDER HEAD BOLTS INSTALLATION

1. Check that the nominal length of each cylinder head bolt meets the limit. If it exceeds the limit, replace the bolt with a new one.

   Limit (A): 99.4 mm (3.91 inches)

2. Apply a small amount of engine oil to the thread of the bolts and to the washers.

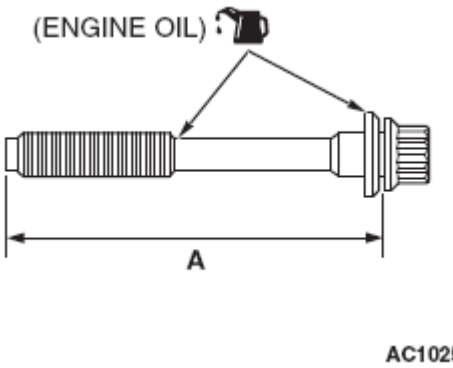


Fig. 87: Cylinder Head Bolt Engine Oil Applying Area

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Use special tool MB991654 to tighten the cylinder head bolts in the following procedures.
    1. Tighten the bolts to 78 ± 2 N.m (58 ± 1 ft-lb) in the order shown.
    2. Loosen the bolts fully in the reverse sequence of that shown.
    3. Tighten the bolts to 20 ± 2 N.m (15 ± 1 ft-lb) in the order shown.
    4. Reconfirm all bolts tightened firmly.

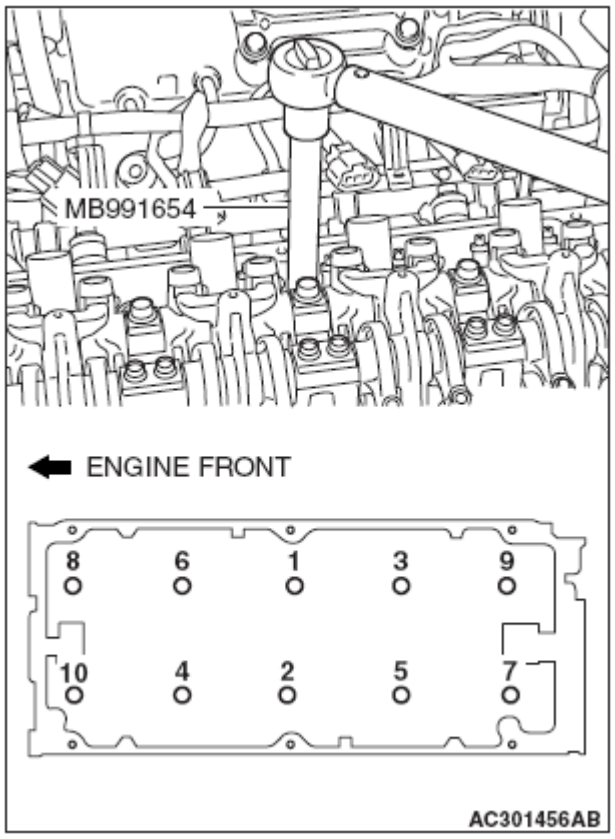


Fig. 88: Cylinder Head Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Apply a paint mark to the heads of the cylinder head bolts and cylinder head, then tighten 90 degrees as shown.

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.**

6. Tighten 90 degrees as shown, then check to see that the paint mark on the head of the cylinder head bolt and the paint mark on the cylinder head are aligned.

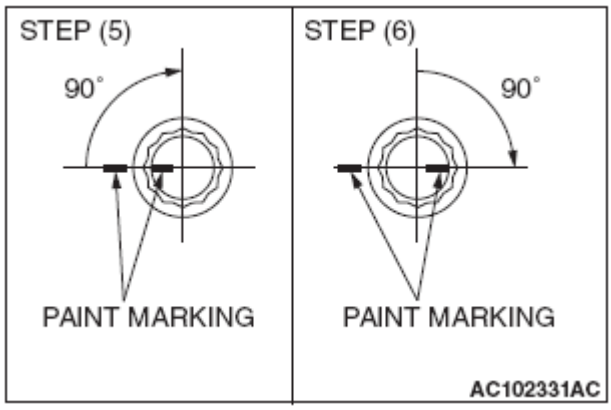


Fig. 89: Cylinder Head Bolts Tightening Angle
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< FUEL HIGH-PRESSURE HOSE CONNECTION

CAUTION: After connecting the fuel high-pressure hose, slightly pull it to ensure that it is installed securely. Also confirm that there is a play approximately 3 mm (0.12 inch). Then install the stopper securely.

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

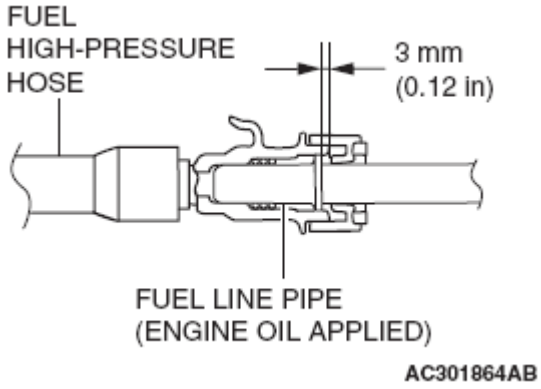


Fig. 90: Fuel Line Pipe Clearance
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

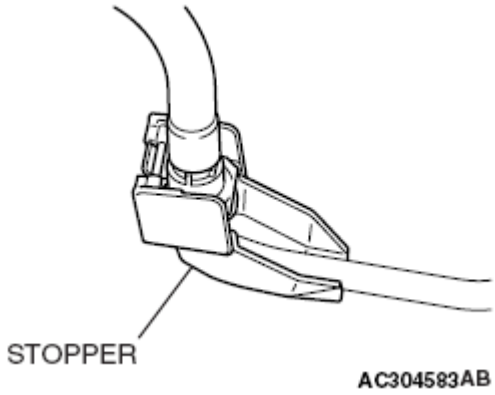


Fig. 91: Identifying Stopper
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< RADIATOR UPPER HOSE CONNECTION

1. Insert radiator upper hose until it contacts the projection on the water outlet fitting.
2. Align the mating marks on the radiator upper hose and hose clamp, and then secure the radiator upper hose.

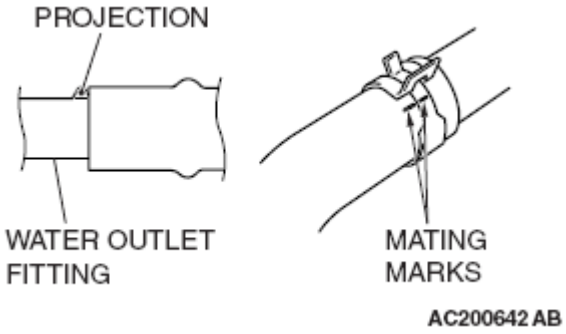


Fig. 92: Mating Marks On Radiator Upper Hose And Hose Clamp
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< CAMSHAFT SPROCKET INSTALLATION

1. Hold the camshaft sprocket with special tools MB990767 and MD998719 in the same manner as removal.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 89 ± 9 N.m (65 ± 7 ft-lb)

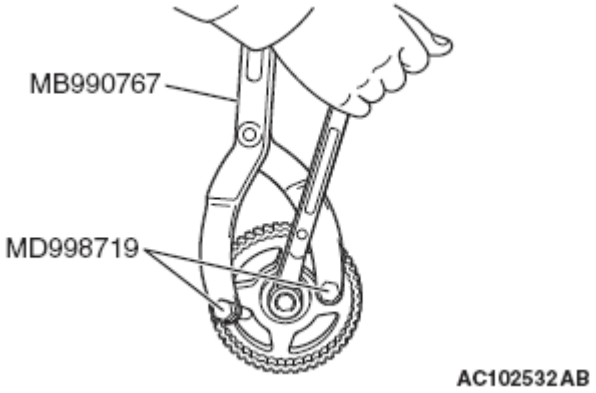


Fig. 93: Installing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< BRAKE BOOSTER VACUUM HOSE CONNECTION

Insert the vacuum hose with its paint mark facing upward.

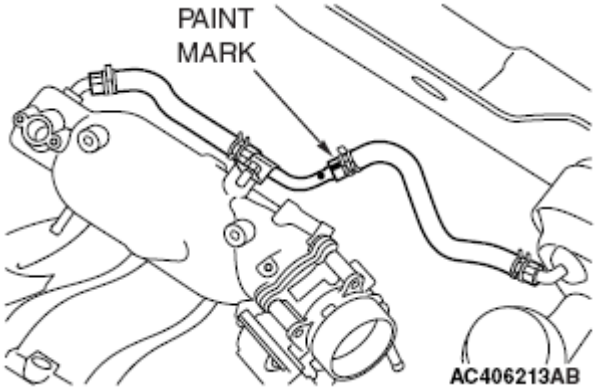
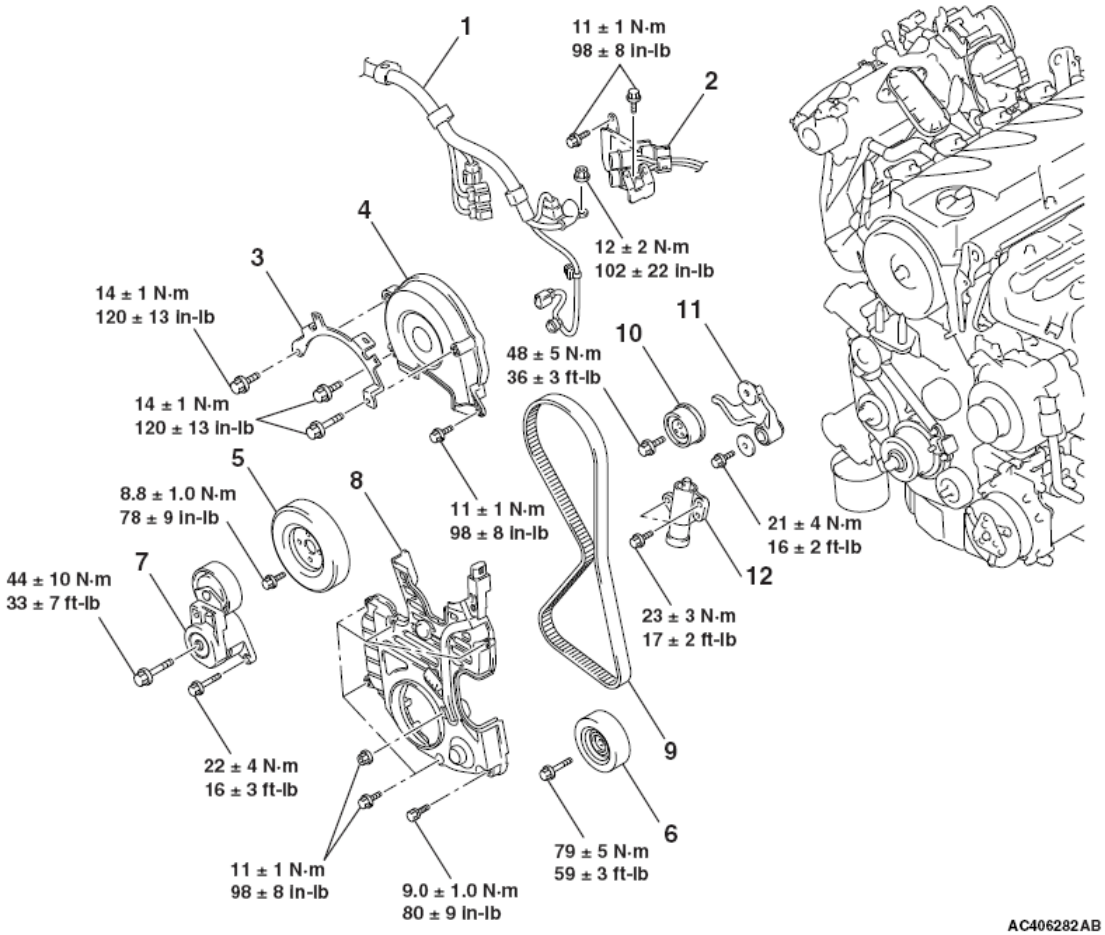


Fig. 94: Vacuum Hose Paint Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING BELT

REMOVAL AND INSTALLATION

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

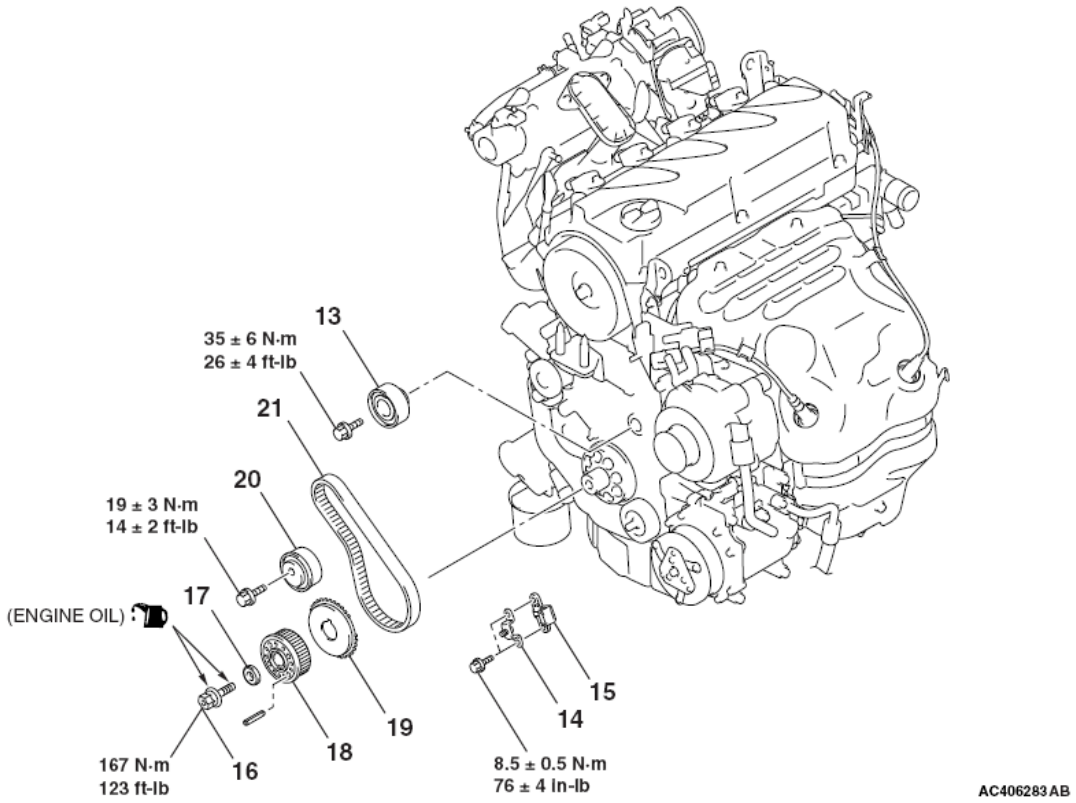
1. CONTROL WIRING HARNESS CONNECTION
2. CONNECTOR BRACKET
3. HARNESS BRACKET
4. TIMING BELT UPPER COVER
   - ENGINE FRONT MOUNTING BRACKET
5. WATER PUMP PULLEY
6. IDLER PULLEY
7. AUTO-TENSIONER
8. TIMING BELT LOWER COVER

<<A>> >>F<< >>E<< >>D<< >>G<<

- VALVE TIMING BELT TENSION ADJUSTMENT (INSTALLATION ONLY)

9. VALVE TIMING BELT
10. TIMING BELT TENSIONER PULLEY
11. TIMING BELT TENSIONER ARM
12. TIMING BELT TENSIONER ADJUSTER

Fig. 95: Removal/Installation Of Timing Belt Components With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



REMOVAL STEPS

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

Fig. 96: Removal/Installation Of Timing Belt Components With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB991367: Special Spanner
- MB991385: Pin
- MB992080: Belt Tension Meter Set
  - MB992081: Belt Tension Meter
  - MB992082: Microphone Assembly
- MD998738: Adjusting Bolt
- MD998767: Tensioner Wrench

REMOVAL SERVICE POINTS

<<A>> VALVE TIMING BELT REMOVAL

CAUTION: Never turn the crankshaft counterclockwise.

1. Turn the crankshaft clockwise, align each timing mark to set number 1 cylinder to TDC of its compression stroke.

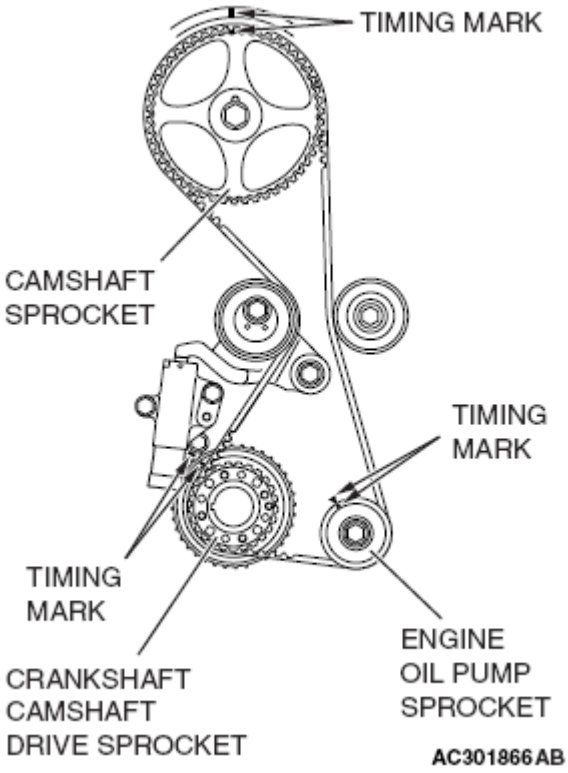


Fig. 97: Identifying Timing Marks On Sprockets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the timing belt under cover rubber plug and then set special tool MD998738.

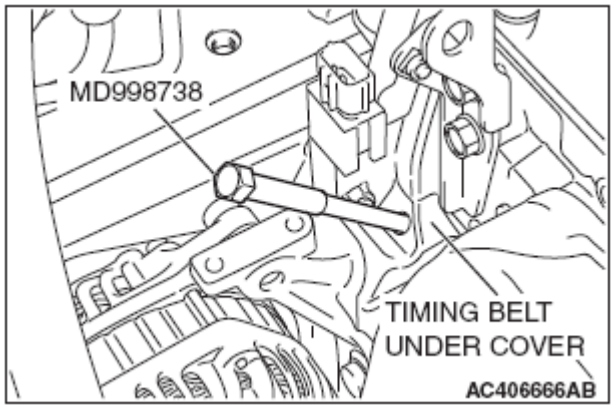


Fig. 98: Setting Special Tool MD998738

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Screw in special tool MD998738 by hand until it contacts the timing belt tensioner arm.

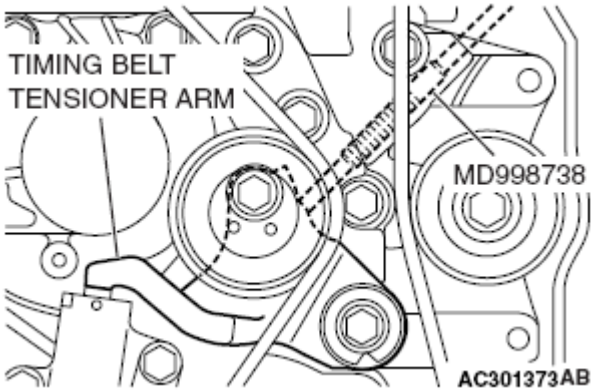


Fig. 99: Identifying Special Tool MD998738 Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Special tool MD998738 must be gradually installed at a rate of 30 degrees per second. If it is screwed in all at once, the timing belt tensioner adjuster rod will not easily retract and special tool MD998738 may bend.

4. Gradually screw in special tool MD998738 and then align the timing belt tensioner adjuster rod set hole A with the timing belt tensioner adjuster cylinder set hole B.

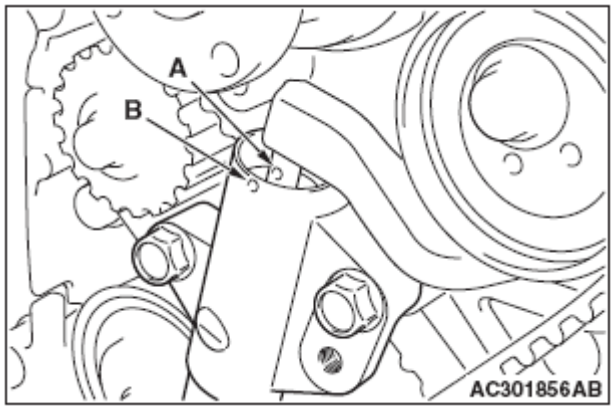


Fig. 100: Identifying Timing Belt Tensioner Adjuster Rod Set Hole A And Cylinder Set Hole B
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Insert a wire or pin in the set hole aligned.

CAUTION: To reuse the valve timing belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

6. After removal of special tool MD998738, loosen the timing belt tensioner pulley mounting bolt and remove the valve timing belt.

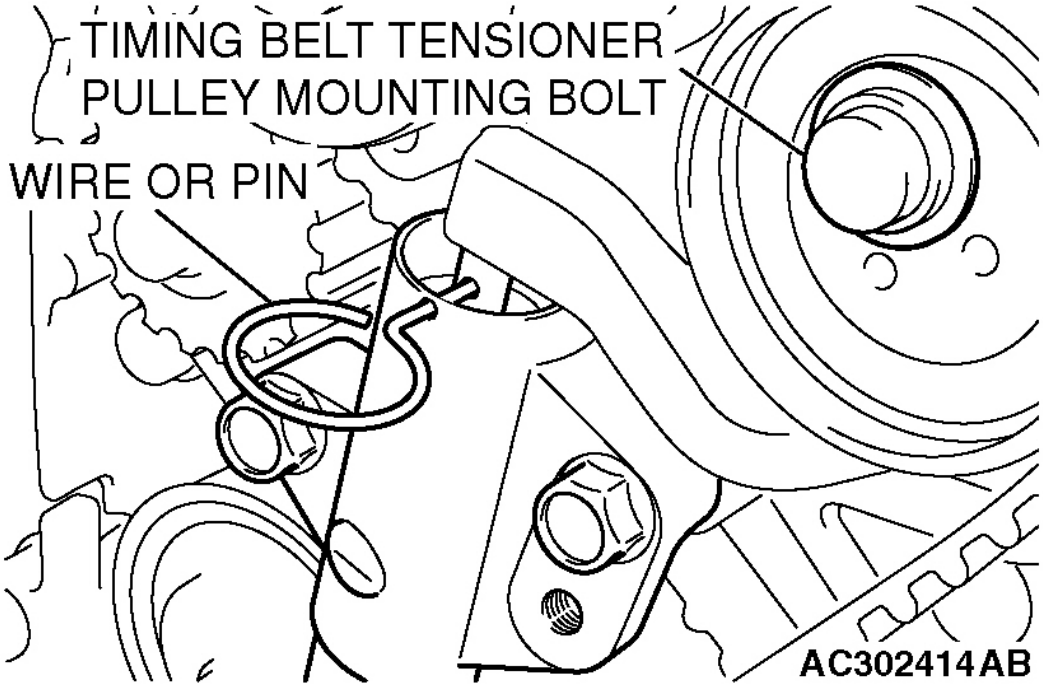


Fig. 101: Inserting Wire Or Pin In Set Hole Aligned
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> CRANKSHAFT PULLEY CENTER BOLT/CRANKSHAFT PULLEY WASHER/CRANKSHAFT CAMSHAFT DRIVE SPROCKET REMOVAL

1. Hold the crankshaft camshaft drive sprocket with special tools MB991367 and MB991385.
2. Loosen the crankshaft pulley center bolt and remove the crankshaft pulley washer and crankshaft camshaft drive sprocket.

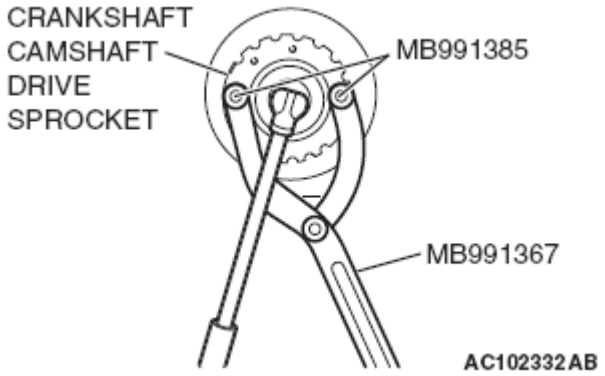


Fig. 102: Holding Crankshaft Camshaft Drive Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<C>> BALANCER TIMING BELT REMOVAL

CAUTION: To reuse the balancer timing belt, draw an arrow indicating the rotating direction on the back of the belt using chalk, etc.

INSTALLATION SERVICE POINTS

>>A<< BALANCER TIMING BELT/BALANCER TIMING BELT TENSIONER INSTALLATION

1. Ensure that the crankshaft balancer shaft drive sprocket timing marks and balancer shaft sprocket timing marks are aligned.
2. Install the balancer timing belt on the crankshaft balancer shaft drive sprocket and balancer shaft sprocket. There should be no slack on the tension side.

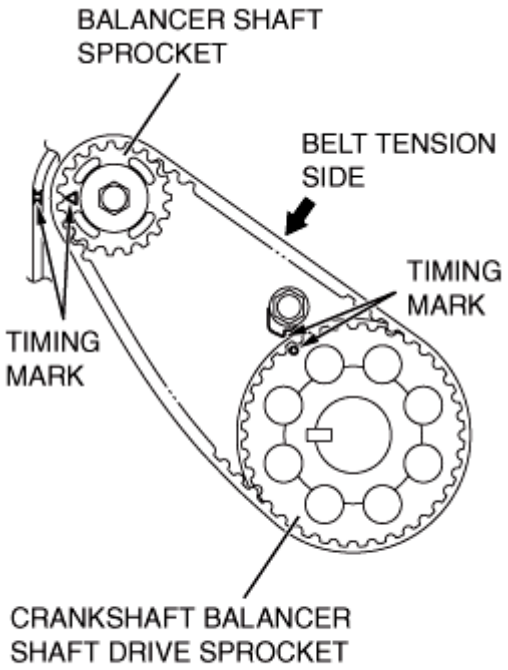


Fig. 103: Sprocket Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Assemble and temporarily secure the center of the pulley of the balancer timing belt tensioner so that it is at the top left from the center of the assembling bolt, and the pulley flange is at the front-side of the engine.
4. Adjust the balancer timing belt tension.

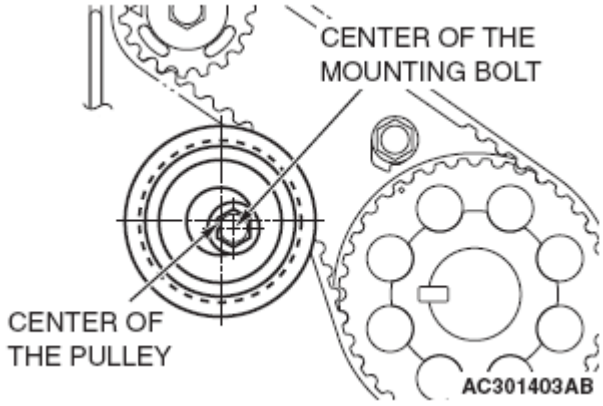


Fig. 104: Identifying Center Of Mounting Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< BALANCER TIMING BELT TENSION ADJUSTMENT

CAUTION: When tightening the mounting bolts, ensure that the tensioner does not rotate with the bolts. Allowing it to rotate with the bolts can cause excessive tension of the belt.

1. Lift with your fingers the balancer timing belt tensioner in the direction of the arrow. Apply a tensile torque of [3.0 ± 0.4 N.m (26 ± 4 in-lb)] to the balancer timing belt so the belt is tense without any looseness. Tighten the assembling bolt to the specified torque in this state. Then, fix the balancer timing belt tensioner.

   Tightening torque: 19 ± 3 N.m (14 ± 2 ft-lb)

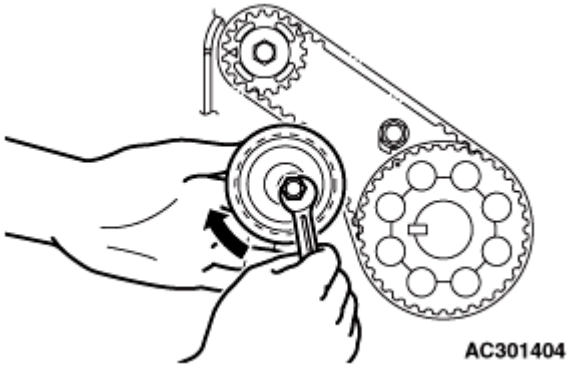


Fig. 105: Tightening Assembling Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Turn the crankshaft clockwise two turns to set number 1 cylinder to TDC of its compression stroke and check that sprocket timing marks are aligned.

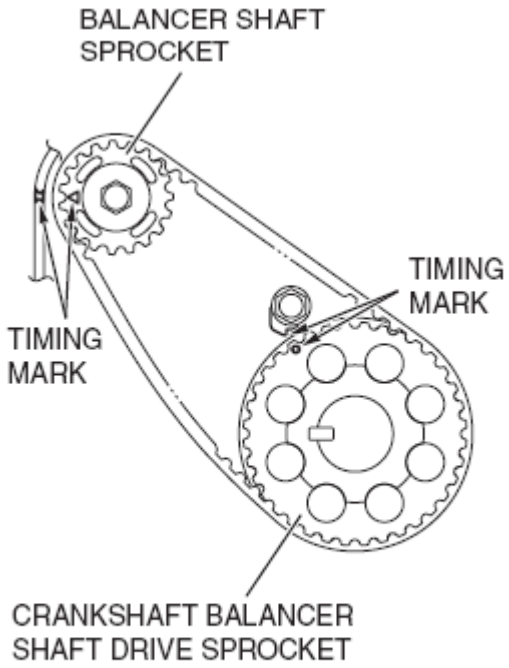


Fig. 106: Crankshaft Balancer Shaft Drive Sprocket Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: When measuring the tension, make sure that the engine is cold.

3. Check the balancer timing belt tension in the following procedure.
    1. With your finger tip lightly tap the center of the balancer timing belt between the sprockets in the location shown by the arrow in the illustration, then check whether the belt vibration frequency is within the standard value.

NOTE: Refer to AUTO-TENSIONER CHECK , for information regarding the vibration frequency measurement method using special tool MB992080.

Standard value: 70 - 100 Hz

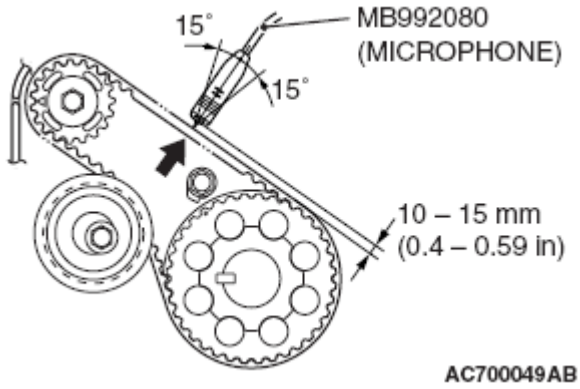


Fig. 107: Checking Timing Belt Vibration Frequency
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Apply a pressure of 59 N (13 pounds) at the center (arrow area) between the sprocket as shown in the figure, then check whether the belt deflection is within the standard value.

   Standard value: 8 - 12 mm (0.31 - 0.47 inch)

4. If not within the standard value, adjust the belt tension again.

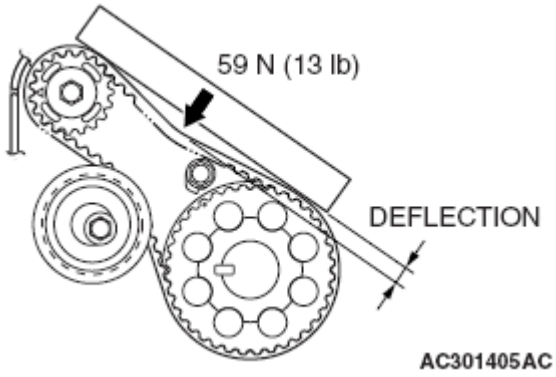


Fig. 108: Identifying Timing Belt Deflection
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< CRANKSHAFT ANGLE SENSING BLADE/CRANKSHAFT CAMSHAFT DRIVE SPROCKET/CRANKSHAFT PULLEY WASHER/CRANKSHAFT PULLEY CENTER BOLT INSTALLATION

1. Clean or degrease the crankshaft, the crankshaft angle sensing blade, the crankshaft camshaft drive sprocket and crankshaft pulley washer as shown.

   NOTE: Also clean the degreased surfaces.

2. Install the crankshaft angle sensing blade and crankshaft camshaft drive sprocket in the direction shown.
3. Place the larger chamfer side of the crank shaft pulley washer in the direction shown in the Figure, and then assemble on the crank shaft pulley center bolt.

4. Apply a small amount of engine oil to the crank shaft pulley center bolt bearing surface and screw.

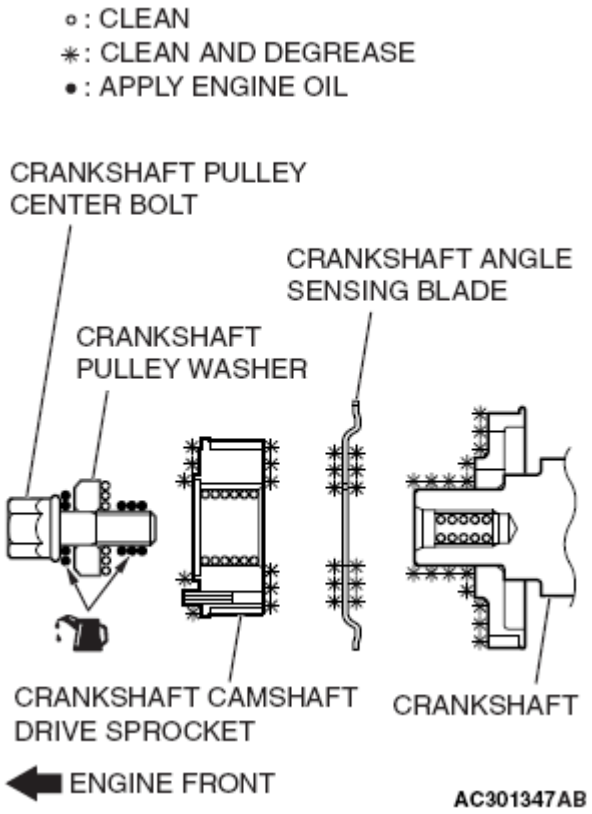


Fig. 109: Crank Shaft Pulley Center Bolt Engine Oil Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Hold the crankshaft camshaft drive sprocket with special tools MB991367 and MB991385 in the same manner as removal.
6. Tighten the crankshaft pulley center bolt to the specified torque.

Tightening torque: 167 N.m (123 ft-lb)

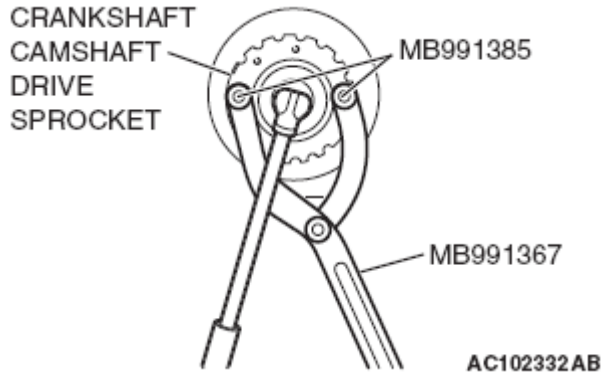


Fig. 110: Holding Crankshaft Camshaft Drive Sprocket

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< TIMING BELT TENSIONER ADJUSTER INSTALLATION

1. Set according to the following procedures with the timing belt tensioner adjuster rod fully extended.

CAUTION: If the rod is compressed too quickly, it may be damaged.

1. Slowly compress the timing belt tensioner adjuster rod using a press or vice, then align set hole A of the rod with set hole B of the timing belt tensioner adjuster cylinder.

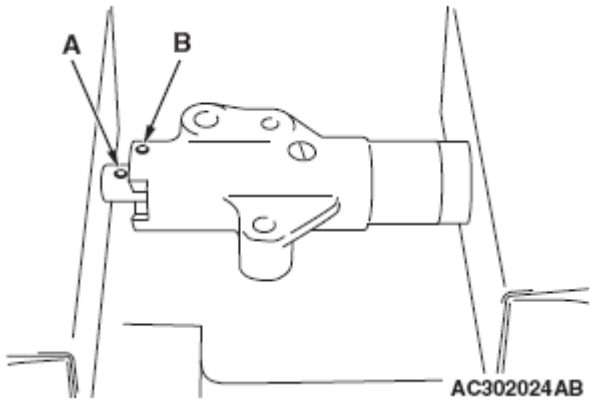


Fig. 111: Identifying Set Hole A And B
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Insert a wire or pin in the set hole aligned.

NOTE: When replacing the timing belt tensioner adjuster with new parts, the timing belt tensioner adjuster is set with a pin.

2. Install the timing belt tensioner adjuster to the engine and then tighten the mounting bolts to the specified torque. Do not remove the wire or pin until the tension of the valve timing belt is adjusted.

Tightening torque: 23 ± 3 N.m (17 ± 2 ft-lb)

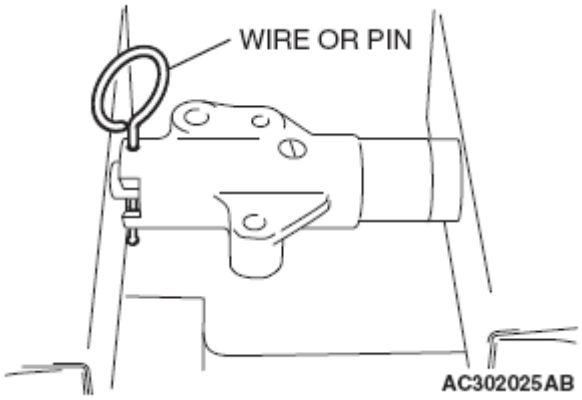


Fig. 112: Inserting Wire Or Pin In Set Hole Aligned
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< TIMING BELT TENSIONER PULLEY INSTALLATION

Temporarily tighten the timing belt tensioner pulley as shown.

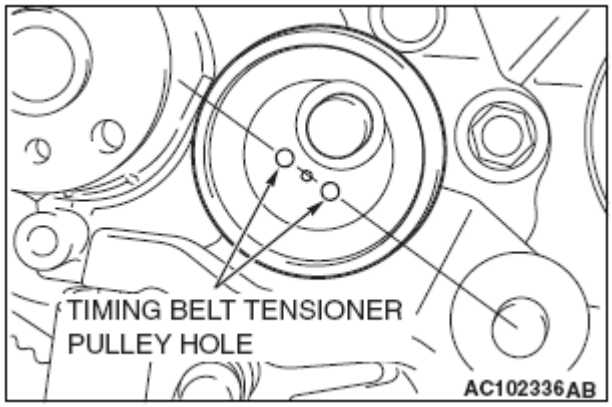


Fig. 113: Timing Belt Tensioner Pulley Holes
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< VALVE TIMING BELT INSTALLATION

1. Align the timing marks on the camshaft sprocket, crankshaft camshaft drive sprocket and engine oil pump sprocket.

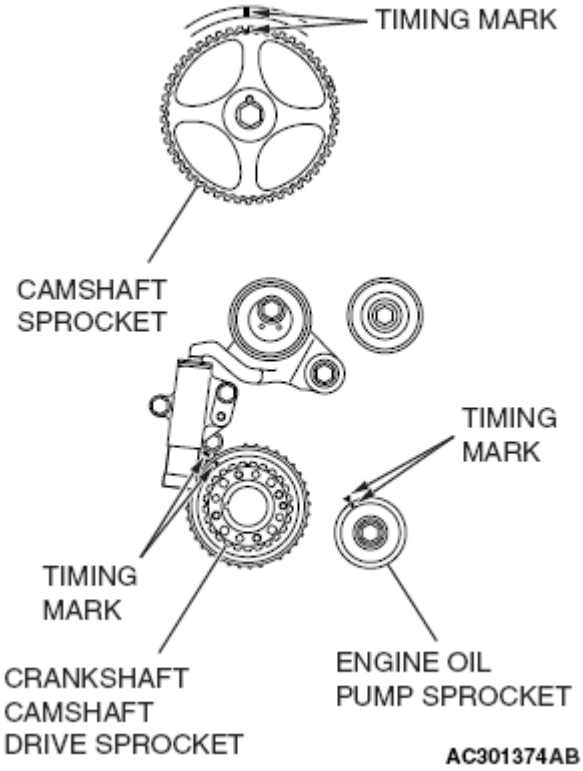


Fig. 114: Identifying Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Adjust the timing mark of the engine oil pump sprocket. Unplug the cylinder block plug. Insert a bolt (M6, section width 10 mm, nominal length 45 mm) in the plug hole. If the bolt comes in contact with the balancer shaft, turn the engine oil sprocket one rotation. Re-adjust the timing mark and then check to see that the bolt fits. Do not remove the bolt until the valve timing belt is assembled.

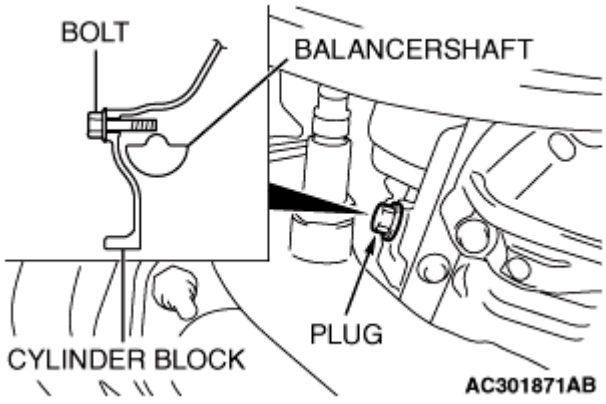


Fig. 115: Identifying Cylinder Block Plug, Cylinder Block And Balancer Shaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Install the valve timing belt in the following manner so that the tensile force of the belt is not lax.
    1. Place the valve timing belt on the timing belt tensioner pulley and crankshaft camshaft driver

sprocket and then support it with your left hand so it does not slide.

2. Place the valve timing belt on the engine oil pump sprocket while pulling it with the right hand.
3. Place the valve timing belt on the timing belt idler pulley.

CAUTION: Install the valve timing belt. Then apply reverse rotation (counterclockwise rotation) pressure to the cam shaft sprocket. Re-check to see that each timing mark is aligned while the tension side of the belt is right.

4. Place the valve timing belt on the camshaft sprocket.

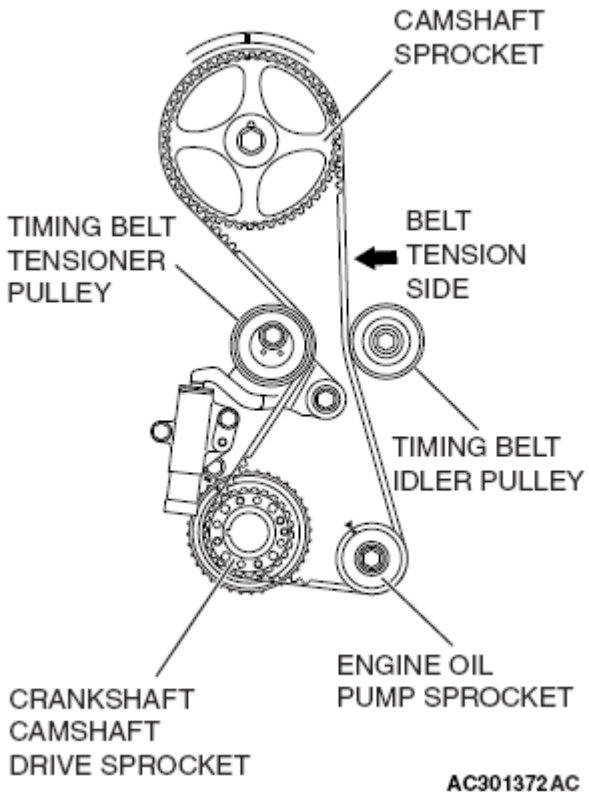


Fig. 116: View Of Valve Timing Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Turn the timing belt tensioner pulley in the direction shown in the figure using special tool MD998767 to apply tension to the valve timing belt. Then temporarily tighten and fix the timing belt tensioner pulley mounting bolt.

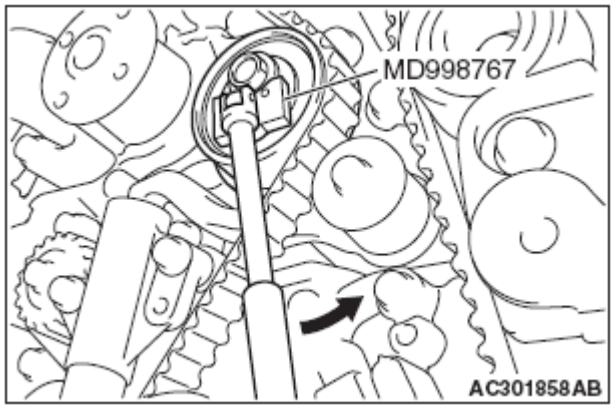


Fig. 117: Turning Timing Belt Tensioner Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Check that the timing marks are aligned.

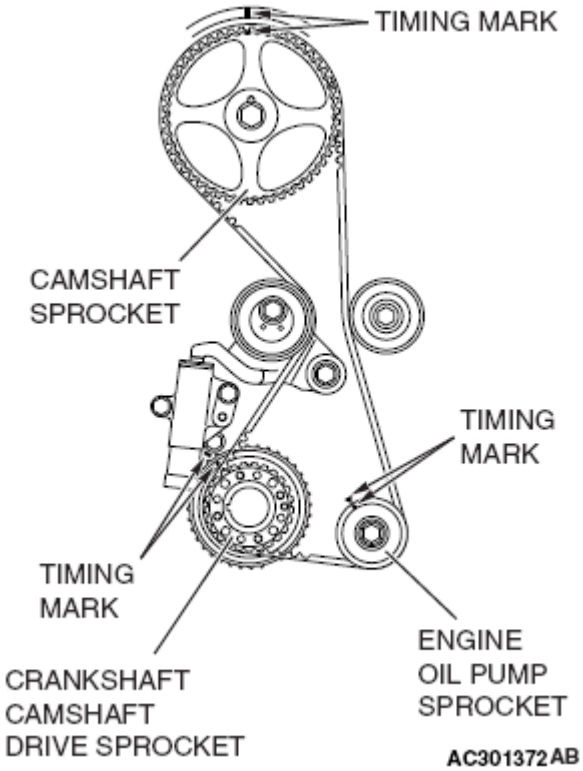


Fig. 118: Aligning Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Remove the bolt inserted in Step 2 above, then assemble the cylinder block plug.
7. Tighten the cylinder block plug to the specified torque.

Tightening torque: 30 ± 3 N.m (23 ± 2 ft-lb)

8. Adjust the valve timing belt tension.

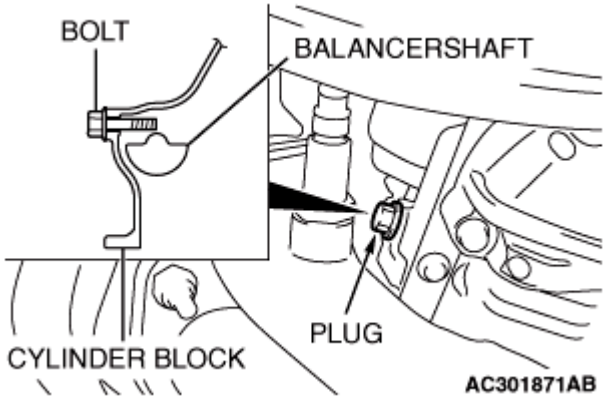


Fig. 119: Identifying Cylinder Block Plug, Cylinder Block And Balancer Shaft
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>G<< VALVE TIMING BELT TENSION ADJUSTMENT

1. Set special tool MD998738 used when removing the valve timing belt.

CAUTION: Always screw in special tool MD998738 by hand, since use of a spanner or other tools may damage the wire or pin inserted in the timing belt tensioner adjuster.

2. Gradually screw in special tool MD998738 until the wire or pin inserted in the timing belt tensioner adjuster lightly moves.

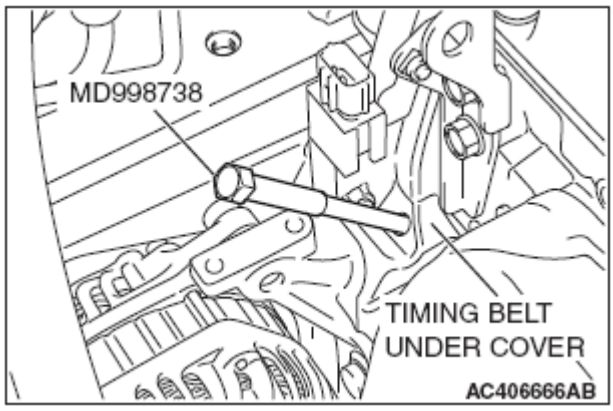


Fig. 120: Setting Special Tool MD998738
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Turn the crankshaft 1/4 turn counterclockwise.
4. Turn the crankshaft clockwise, and align each timing mark to set number 1 cylinder to TDC of its compression stroke.

5. Loosen the timing belt tensioner pulley mounting bolt.

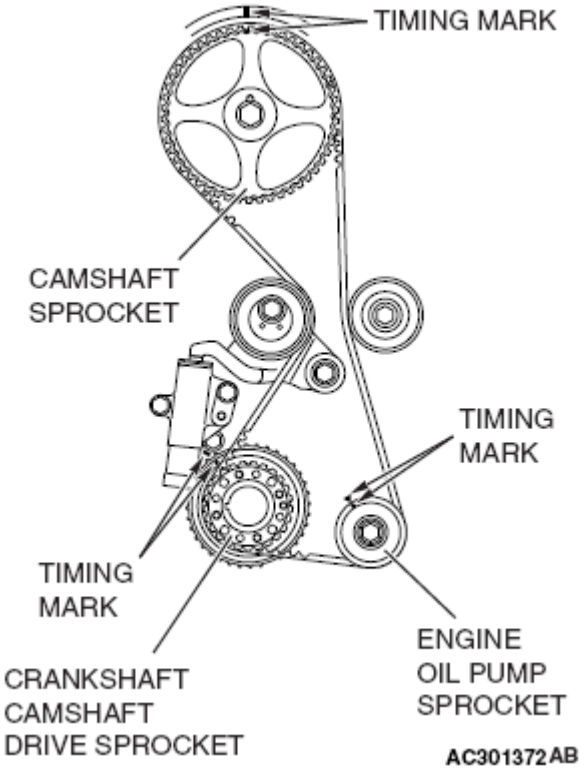


Fig. 121: Aligning Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: When tightening the mounting bolt, ensure that the timing belt tensioner pulley does not rotate with the bolt. Allowing it to rotate with the bolt can cause deficient tension of the belt.

6. With special tool MD998767 and torque wrench, apply tension torque [3.5 N.m (31 in-lb)] to the valve timing belt, and tighten the timing belt tensioner pulley mounting bolt to the specified torque.

Tightening torque: 48 ± 5 N.m (36 ± 3 ft-lb)

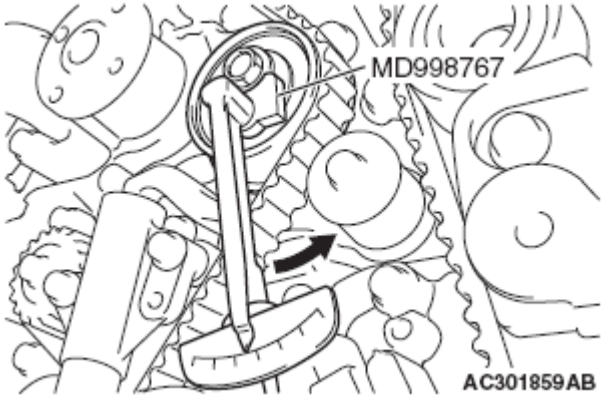


Fig. 122: Tightening Timing Belt Tensioner Pulley Mounting Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. Remove the wire or pin inserted to timing belt tensioner adjuster.

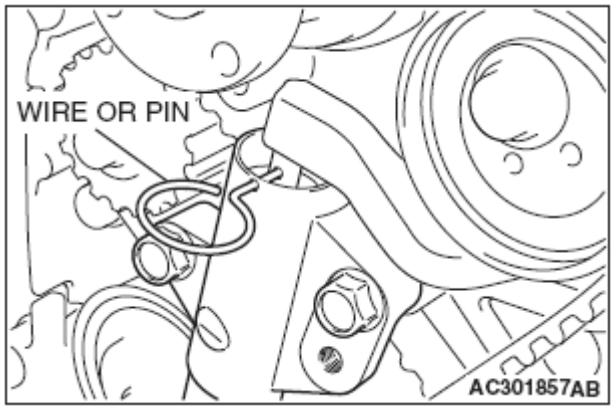


Fig. 123: Identifying Wire Or Pin
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. Remove special tool MD998738, and install the rubber plug to the timing belt under cover.
9. Rotate crankshaft clockwise two turns, and leave it for about 15 minutes.

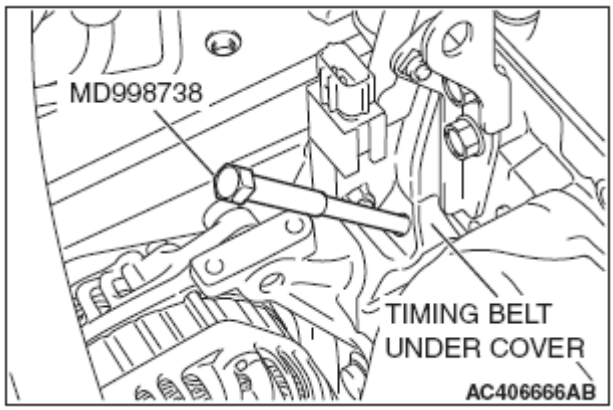


Fig. 124: Setting Special Tool MD998738
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

10. Insert the wire or pin removed in Step 7 again, and ensure that it can be pulled out easily. When the wire or pin can be easily removed, appropriate tension is applied on timing belt. In this case, remove wire or pin.

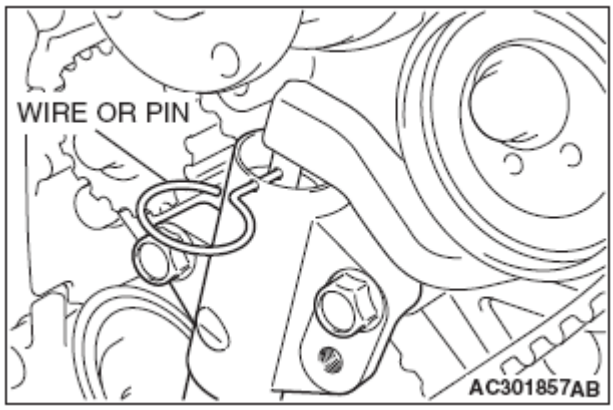


Fig. 125: Identifying Wire Or Pin
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Also when the projection of timing belt tensioner adjuster rod (A) is within the standard value, appropriate tension is applied.

Standard value (A): 3.8 - 4.5 mm (0.15 - 0.17 inch)

11. If wire or pin cannot be easily pulled out, repeat Step 1 through Step 9 to reach proper valve timing belt tension.

CAUTION: Always check the tightening torque of the crank shaft pulley center bolt when turning the crank shaft pulley center bolt counterclockwise. Re-tighten if it is loose.

12. Check again that the timing marks on sprockets are aligned.

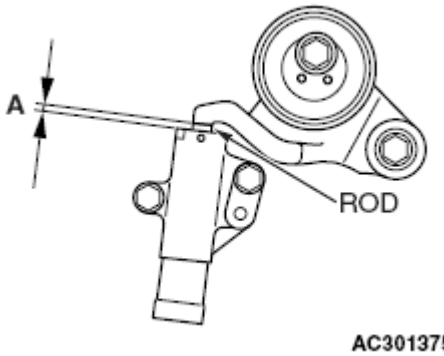


Fig. 126: Identifying Projection Of Timing Belt Tensioner Adjuster Rod
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

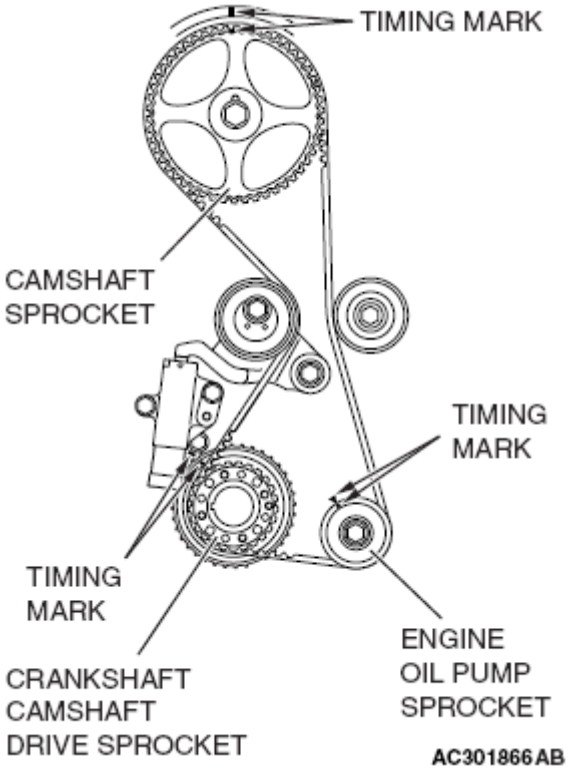


Fig. 127: Identifying Timing Marks On Sprockets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSPECTION

TIMING BELT TENSIONER ADJUSTER CHECK

1. Check for oil leak from seal, and replace it if a leak is detected.
2. Check for wear or damage at the top of the rod. Replace it, if required.
3. Hold the timing belt tensioner adjuster by hand, and press the top end of the rod onto the metal (e.g. cylinder block) with 98 - 196 N (22 - 44 pounds) of pressure, and measure the movement of the rod.

   Standard value: Within 1 mm (0.039 inch)

   A: Length when it is free (not pressed)

   B: Length when it is pressed

   A - B: Movement

4. If the measured value is out of the standard value, replace the timing belt tensioner adjuster.

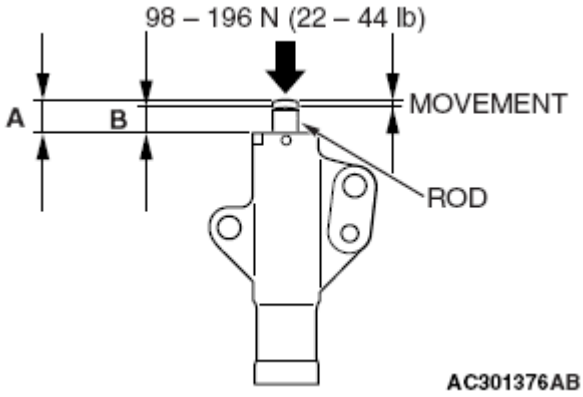


Fig. 128: Checking Timing Belt Tensioner Adjuster
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

BALANCER TIMING BELT TENSION CHECK

Required Special Tools:

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

CAUTION:
- **When measuring the tension, make sure that the engine is cold.**
- **Measure the tension after turning the crankshaft clockwise two turns or more.**

Check the balancer timing belt tension in the following procedures.

1. With your finger tip lightly tap the center of the balancer timing belt between the sprockets in the location shown by the arrow in the illustration, then check whether the belt vibration frequency is within the standard value.

NOTE: **Refer to AUTO-TENSIONER CHECK , for information regarding the vibration frequency measurement method using special tool MB992080.**

Standard value: 70 - 100 Hz

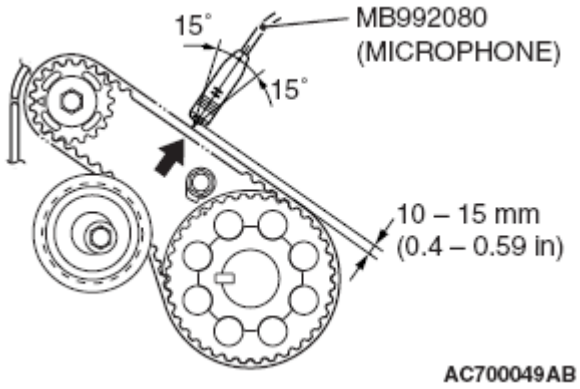


Fig. 129: Checking Timing Belt Vibration Frequency
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Apply a pressure of 59 N (13 pounds) at the center (arrow area) between the sprocket as shown in the figure, then check whether the belt deflection is within the standard value.

   Standard value: 8 - 12 mm (0.31 - 0.47 inch)

3. If not within the standard value, adjust the belt tension. (Refer to **TIMING BELT**).

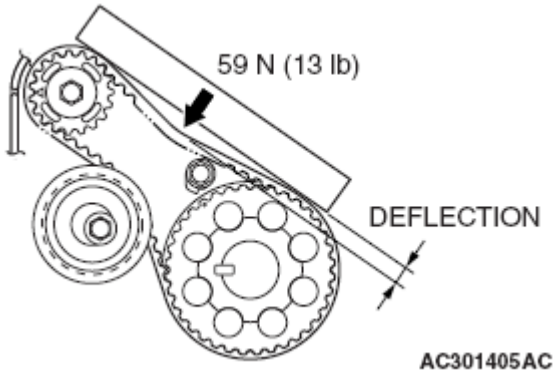


Fig. 130: Identifying Timing Belt Deflection
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

ITEM	SPECIFICATION
Camshaft and valve stem seal	
Accumulator assembly	44 ± 5 N.m (33 ± 3 ft-lb)
Camshaft position sensing cylinder bolt	22 ± 4 N.m (16 ± 3 ft-lb)
Camshaft position sensor support bolt	14 ± 1 N.m (120 ± 13 in-lb)

Camshaft sprocket bolt		89 ± 9 N.m (65 ± 7 ft-lb)
Connector bracket bolt		11 ± 1 N.m (98 ± 8 in-lb)
Control wiring harness bolt		9.0 ± 2.0 N.m (80 ± 17 in-lb)
Control wiring harness protector bolt		5.0 ± 1.0 N.m (44 ± 9 in-lb)
Cylinder head plug		47 ± 7 N.m (35 ± 5 ft-lb)
Engine oil control valve bolt		11 ± 1 N.m (98 ± 8 in-lb)
Engine oil pressure switch		10 ± 2 N.m (89 ± 17 in-lb)
Exhaust rocker arm shaft bolt		13 ± 1 N.m (115 ± 9 in-lb)
Intake rocker arm shaft bolt		31 ± 3 N.m (23 ± 2 ft-lb)
Rocker cover assembly bolt		3.5 ± 0.5 N.m (31 ± 4 in-lb)
Spark plug		25 ± 4 N.m (18 ± 3 ft-lb)
Crankshaft oil seal		
A/T drive plate bolt		132 ± 5 N.m (98 ± 3 ft-lb)
Flywheel bolt		132 ± 5 N.m (98 ± 3 ft-lb)
Crankshaft pulley		
Crankshaft damper pulley bolt		25 ± 4 N.m (18 ± 3 ft-lb)
Cylinder head gasket		
Camshaft sprocket bolt		89 ± 9 N.m (65 ± 7 ft-lb)
Control wiring harness bolt		9.0 ± 2.0 N.m (80 ± 17 in-lb)
Control wiring harness protector bolt		5.0 ± 1.0 N.m (44 ± 9 in-lb)
Cylinder head bolt <Cold engine>		78 ± 2 N.m to 0 N.m to 20 ± 2 N.m to +90° to +90° to (58 ± 1 ft-lb to 0 in-lb to 15 ± 1 ft-lb to +90° to +90°)
Engine oil dipstick guide bolt		13 ± 1 N.m (115 ± 9 in-lb)
Generator terminal nut		12 ± 2 N.m (102 ± 22 in-lb)
Intake manifold stay bolt		31 ± 3 N.m (23 ± 2 ft-lb)
Knock sensor connector bracket bolt		11 ± 1 N.m (98 ± 8 in-lb)
Pressure hose clamp bolt		12 ± 2 N.m (102 ± 22 in-lb)
Radiator lower hose clamp bolt		11 ± 1 N.m (98 ± 8 in-lb)
Water hose clamp bolt		11 ± 1 N.m (98 ± 8 in-lb)
Engine assembly		
ATF warmer (transmission fluid cooler) bracket bolt		23 ± 3 N.m (17 ± 2 ft-lb)
Battery terminal nut		5.0 ± 1.0 N.m (44 ± 9 in-lb)
Control wiring harness bolt and nut		9.0 ± 2.0 N.m (80 ± 17 in-lb)
Control wiring harness protector bolt		5.0 ± 1.0 N.m (44 ± 9 in-lb)
Engine front mounting bracket bolt	M10	58 ± 7 N.m (43 ± 5 ft-lb)
Engine front mounting bracket bolt and nut	M12	83 ± 12 N.m (61 ± 9 ft-lb)
Grounding cable bolt		9.0 ± 2.0 N.m (80 ± 17 in-lb)
Power steering oil pump bracket bolt		24 ± 4 N.m (18 ± 3 ft-lb)
Power steering oil pump bracket nut		44 ± 10 N.m (33 ± 7 ft-lb)
Pressure hose clamp bolt		12 ± 2 N.m (102 ± 22 in-lb)

Oil pan		
Baffle plate bolt	M6	10 ± 2 N.m (89 ± 17 in-lb)
	M8	24 ± 4 N.m (18 ± 2 ft-lb)
Engine oil pan bolt		9.0 ± 3.0 N.m (80 ± 26 in-lb)
Engine oil pan drain plug		39 ± 5 N.m (29 ± 3 ft-lb)
Engine oil pan strainer bolt		19 ± 3 N.m (14 ± 2 ft-lb)
Torque converter housing front lower cover bolt (bolt, flange)	M10	26 ± 5 N.m (19 ± 4 ft-lb)
Torque converter housing front lower cover bolt (bolt, washer assembled)	M6	9.0 ± 1.0 N.m (80 ± 9 in-lb)
Timing belt		
Auto-tensioner bolt (bolt, washer assembled)	M8	22 ± 4 N.m (16 ± 3 ft-lb)
	M10	44 ± 10 N.m (33 ± 7 ft-lb)
Balancer timing belt tensioner bolt		19 ± 3 N.m (14 ± 2 ft-lb)
Connector bracket bolt		11 ± 1 N.m (98 ± 8 in-lb)
Crankshaft position sensor bolt		8.5 ± 0.5 N.m (76 ± 4 in-lb)
Crankshaft pulley center bolt		167 N.m (123 ft-lb)
Cylinder block plug		30 ± 3 N.m (23 ± 2 ft-lb)
Generator terminal nut		12 ± 2 N.m (102 ± 22 in-lb)
Idler pulley bolt		79 ± 5 N.m (59 ± 3 ft-lb)
Timing belt idler pulley bolt		35 ± 6 N.m (26 ± 4 ft-lb)
Timing belt lower cover bolt (bolt, flange)	M6	11 ± 1 N.m (98 ± 8 in-lb)
Timing belt lower cover bolt (bolt, washer assembled)	M6	9.0 ± 1.0 N.m (80 ± 9 in-lb)
Timing belt lower cover bracket bolt		8.5 ± 0.5 N.m (76 ± 4 in-lb)
Timing belt lower cover nut		11 ± 1 N.m (98 ± 8 in-lb)
Timing belt tensioner adjuster bolt		23 ± 3 N.m (17 ± 2 ft-lb)
Timing belt tensioner arm bolt		21 ± 4 N.m (16 ± 2 ft-lb)
Timing belt tensioner pulley bolt		48 ± 5 N.m (36 ± 3 ft-lb)
Timing belt upper cover bolt (bolt, flange)	M6	11 ± 1 N.m (98 ± 8 in-lb)
	M8	14 ± 1 N.m (120 ± 13 in-lb)
Water pump pulley bolt		8.8 ± 1.0 N.m (78 ± 9 in-lb)

SERVICE SPECIFICATIONS

SERVICE SPECIFICATIONS

ITEM		STANDARD VALUE	LIMIT
Drive belt tension (Reference)	Vibration frequency Hz	120 - 154	-
	Tension N (lb)	340 - 562 (76 - 126)	-
Valve clearance (at hot) mm (in)	Intake valve	0.20 (0.008)	-
	Exhaust valve	0.30 (0.012)	-

Actual ignition timing at idle		Approximately 10° BTDC	-
Basic ignition timing at idle		5°BTDC ± 3°	-
CO content%		0.5 or less	-
HC contents ppm		100 or less	-
Curb idle speed r/min		700 ± 100	-
Compression pressure (250 - 400 r/min) kPa (psi)		1,560 (226)	Minimum 1,130 (164)
Compression pressure difference of all cylinder kPa (psi)		-	98 (14)
Intake manifold vacuum at curb idle kPa (in Hg)		-	Minimum 60 (18)
Cylinder block heater unit internal resistance ohms		28 - 40	-
Cylinder head bolt nominal length mm (in)		-	99.4 (3.91)
Balancer timing belt tension	Vibration frequency Hz	70 - 100	-
	Deflection mm (in)	8 - 12 (0.31 - 0.47)	-
Timing belt tensioner adjuster rod protrusion amount mm (in)		3.8 - 4.5 (0.15 - 0.17)	-
Timing belt tensioner adjuster rod movement mm (in)		Within 1 (0.039)	-

SEALANTS

SEALANTS SPECIFICATION

ITEM	SPECIFIED SEALANT
Camshaft position sensor support	3M™ AAD Part No. 8672, 3M™ AAD Part No. 8679/8678 or equivalent
Engine oil pressure switch	
Engine oil pan	3M™ AAD Part No. 8672, 8704, 3M™ AAD Part No. 8679/8678 or equivalent