

# ENGINE <1.8L>

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11109000733

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## GENERAL INFORMATION

## GENERAL SPECIFICATIONS

Items			Specifications
Type			In-line, Overhead Camshaft
Number of cylinders			4
Bore mm (in.)			81.0 (3.19)
Stroke mm (in.)			89.0 (3.50)
Piston displacement cm <sup>3</sup> (cu.in.)			1,834 (111.9)
Compression ratio			9.5
Firing order			1 - 3 - 4 - 2
Valve timing	Intake valve	Opens	BTDC 6°
		Closes	ABDC 54°
	Exhaust valve	Opens	BBDC 54°
		Closes	ATDC 6°
Lubrication			Pressurized feed-full filtration

## SERVICE SPECIFICATIONS

Items		Standard value	Limit
Generator drive belt vibration frequency Hz	When checked	151 - 195	-
	When a used belt is installed	163 - 185	-
	When a new belt is installed	195 - 230	-
Generator drive belt tension N (lbs.)	When checked	294 - 490 (66 - 110)	-
	When a used belt is installed	343 - 441 (77 - 99)	-
	When a new belt is installed	490 - 686 (110 - 154)	-
Generator drive belt deflection (Reference value) mm (in.)	When checked	8.0 - 10.5 (.31 - .41)	-
	When a used belt is installed	8.5 - 10.0 (.33 - .39)	-
	When a new belt is installed	7.0 - 8.0 (.28 - .31)	-
Power steering oil pump and A/C compressor drive belt vibration frequency Hz	When checked	114 - 139	-
	When a used belt is installed	121 - 133	-
	When a new belt is installed	145 - 166	-
Power steering oil pump and A/C compressor drive belt tension N (lbs.)	When checked	392 - 588 (88 - 132)	-
	When a used belt is installed	441 - 539 (99 - 121)	-
	When a new belt is installed	637 - 833 (143 - 187)	-

Items		Standard value	Limit
Power steering oil pump and A/C compressor drive belt deflection (Reference value) mm (in.)	When checked	10.0 - 12.0 (.39 - .47)	-
	When a used belt is installed	10.0 - 11.0 (.39 - .43)	-
	When a new belt is installed	7.2 - 9.0 (.28 - .36)	-
Basic ignition timing at idle		5° BTDC ± 3°	-
Actual ignition timing at curb idle		Approx. 5° BTDC	-
CO contents %		0.5 or less	-
HC contents ppm		100 or less	-
Curb idle speed r/min		700 ± 100	-
Compression pressure (at 300 r/min) kPa (psi)		1,370 (199)	min. 1,040 (151)
Compression pressure difference of all cylinders kPa (psi)		-	max. 100 (14)
Intake manifold vacuum at curb idle kPa (in.Hg)		-	min. 60 (18)
Cylinder head bolt shank length mm (in.)		-	96.4 (3.80)

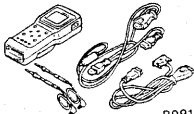
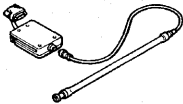
## SEALANTS

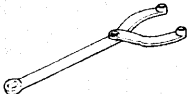
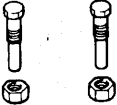
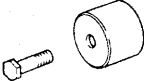

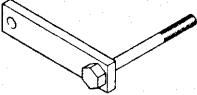

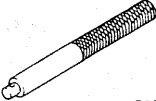
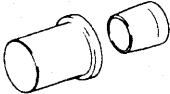
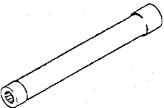
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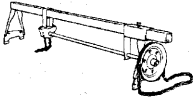
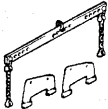
Items	Specified sealants
Oil pan Camshaft position sensor support	MITSUBISHI GENUINE PART MD970389 or equivalent
Flywheel bolt <M/T> or drive plate bolt <A/T>	3M Stud Locking 4170 or equivalent

## SPECIAL TOOLS

11100060648

Tool	Tool number and name	Supersession	Application
 B991502	MB991502 Scan tool (MUT-II)	MB991496-OD	<ul style="list-style-type: none"> <li>● Checking the ignition timing</li> <li>● Checking the idle speed</li> </ul>
	MB991668 Belt tension meter set	Tool not available	Drive belt tension measurement

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder	MB990767-01	<ul style="list-style-type: none"> <li>● Holding the camshaft sprocket</li> <li>● Holding the crankshaft pulley</li> </ul>
	MD998719 or MD998754 Crankshaft pulley holder	MIT308239	
	MD998713 Camshaft oil seal installer	MD998713-01	Press-in of the camshaft oil seal
	MD998727 Oil pan remover	MD998727-01	Removal of oil pan
	MD998781 Flywheel stopper	General service tool	Securing the flywheel <M/T> or drive plate <A/T>
	MD998776 Crankshaft rear oil seal installer	MD998776-01	Press-in of the crankshaft rear oil seal
 <p data-bbox="179 1126 238 1141">B990938</p>	MB990938 Handle	MB990938-01	
	MD998717 Crankshaft front oil seal installer	MD998717-01	Press-in of the crankshaft front oil seal
	MB991653 Cylinder head bolt wrench	General service tool	Removal and installation of the cylinder head bolt

Tool	Tool number and name	Supersession	Application
 <p>Z203827</p>	GENERAL SERVICE TOOL MZ203827 Engine lifter	MZ203827-01	Supporting the engine assembly during removal and installation of the transaxle
 <p>B991453</p>	MB991453 Engine hanger assembly	MZ203827-01	

## TROUBLESHOOTING

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Refer to GROUP 11A - Troubleshooting.

## ON-VEHICLE SERVICE

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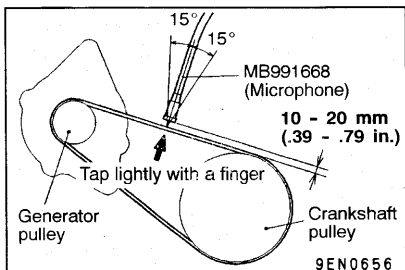
## DRIVE BELT TENSION CHECK AND ADJUSTMENT

## GENERATOR DRIVE BELT TENSION CHECK

Check drive belt tension in one of the following procedures.

## Standard value:

Vibration frequency Hz	151 - 195
Tension N (lbs.)	294 - 490 (66 - 110)
Deflection (Reference value) mm (in.)	8.0 - 10.5 (.31 - .41)



## &lt;When using the scan tool (MUT-II)&gt;

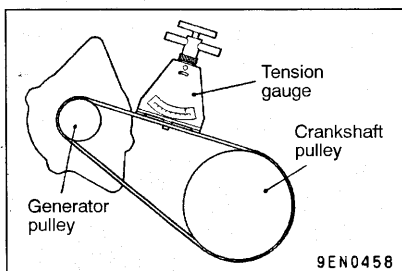
1. Connect the belt tension meter set (special tool) to the scan tool (MUT-II).
2. Connect the scan tool (MUT-II) to the diagnosis connector.
3. Turn the ignition switch to "ON" and select "Belt Tension Measurement" on the menu screen.
4. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by an arrow) about 10 - 20 mm (0.39 - 0.79 in.) away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of  $\pm 15^\circ$ ).
5. Lightly tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration. Check that the vibration frequency of the belt is within the standard value.

## Caution

1. The temperature of the surface of the belt should be as close as possible to normal temperature.
2. Do not allow any contaminant such as water or oil to get onto the microphone.
3. If strong gusts of wind blow against the microphone or if there is any source of loud noise nearby, the values measured by the microphone may not correspond to actual values.
4. If the microphone is touching the belt during the measurement, the values measured by the microphone may not correspond to actual values.
5. Do not take the measurement while the vehicle's engine is running.

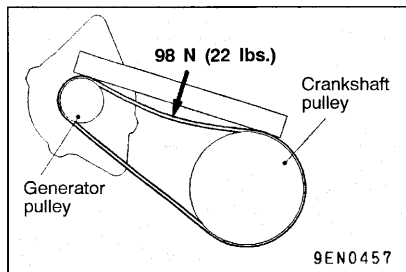
## &lt;When using a tension gauge&gt;

Use a belt tension gauge to check that the belt tension is within the standard value range.



## &lt;Belt deflection check&gt;

Apply 98 N (22 lbs.) of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value range.



## GENERATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the generator pivot bolt.
2. Loosen the lock bolt.
3. Turn the adjusting bolt to adjust the belt tension vibration frequency, belt tension or deflection to the standard value.

## Standard value:

Items	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	163 - 185	195 - 230
Tension N (lbs.)	343 - 441 (77 - 99)	490 - 686 (110 - 154)
Deflection (Reference value) mm (in.)	8.5 - 10.0 (.33 - .39)	7.0 - 8.0 (.28 - .31)

4. Tighten the nut of the generator pivot bolt.

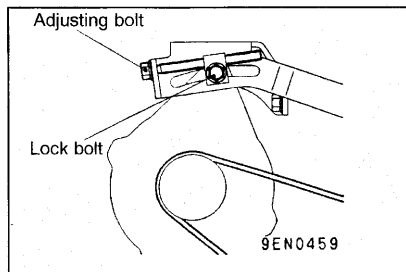
**Tightening torque: 44 Nm (33 ft.lbs.)**

5. Tighten the lock bolt.

**Tightening torque: 23 Nm (17 ft.lbs.)**

6. Tighten the adjusting bolt.

**Tightening torque: 9.8 Nm (7.2 ft.lbs.)**



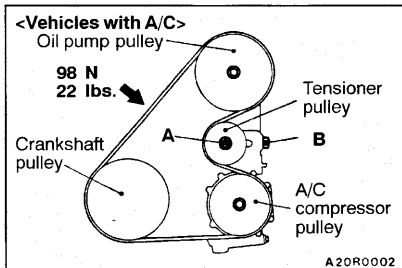
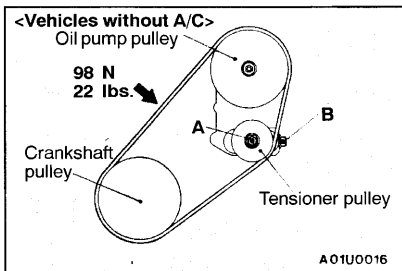
## POWER STEERING OIL PUMP AND AIR CONDITIONING COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

11100130202

1. Check drive belt tension in one of the following procedures.

### Standard value:

Items	When checked	When a used belt is intalled	When a new belt is installed
Vibration frequency Hz	114 - 139	121 - 133	145 - 166
Tension N (lbs.)	392 - 588 (88 - 132)	441 - 539 (99 - 121)	637 - 833 (143 - 187)
Deflection (Reference value) mm (in.)	10.0 - 12.0 (.39 - .47)	10.0 - 11.0 (.39 - .43)	7.2 - 9.0 (.28 - .35)



### <When using the scan tool (MUT-II)>

Lightly tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration. Check that the vibration frequency of the belt is within the standard value.

### NOTE

Check drive belt vibration frequency with the scan tool (MUT-II) in the same procedure in WATER PUMP AND GENERATOR. (Refer to page 11C-6.)

### <When using a tension gauge>

Use a belt tension gauge to check that the belt tension is at the standard value at a point half-way between the two pulleys (indicated by an arrow in the illustration).

### <Belt deflection check>

Apply 98 N (22 lbs.) of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value range.

2. If the tension or deflection is outside the standard value, adjust by the following procedure.
  - (1) Loosen tensioner pulley fixing nut A.
  - (2) Adjust the amount of belt deflection using adjusting bolt B.
  - (3) Tighten fixing nut A.

**Tightening torque: 25 Nm (19 ft.lbs.)**

- (4) Check the belt deflection amount and tension, and readjust if necessary.

### Caution

**Check after turning the crankshaft once or more clockwise (right turn).**



**IGNITION TIMING CHECK**

11100170150

1. Before inspection, set the vehicle in the following condition:
  - Engine coolant temperature: 80 - 95°C (176 - 203°F)
  - Lights, electric cooling fan and all accessories: OFF
  - Transaxle: Neutral (P range on vehicles with A/T)
2. Connect the scan tool to the data link connector.
3. Set up a timing light.
4. Start the engine and run at idle.
5. Check that the idle speed is at approx. 700 r/min.
6. Select the 'item No.17' of the actuator test on the scan tool.
7. Check that basic ignition timing is within the standard value.

**Standard value: 5° BTDC ± 3°**

8. If the basic ignition timing is outside the standard value, check the MFI components by referring to GROUP 13A - Troubleshooting.
9. Press the clear key of the scan tool (select force-activating cancel mode), and cancel the actuator test.

**NOTE**

If it is not cancelled, force-activation continues for 27 minutes. Do not drive the vehicle in this condition, or the engine could be damaged.

10. Check the actual ignition timing is at the standard value.

**Standard value: Approx. 5° BTDC****NOTE**

1. Ignition timing is variable within about ±7°, even under normal operating.
2. The timing is automatically further advanced by approx. 5° from 5° BTDC at higher altitude.

**CURB IDLE SPEED CHECK**

11100190545

1. Before inspection, set the vehicle in the following condition:
  - Engine coolant temperature: 80 - 95°C (176 - 203°F)
  - Lights, electric cooling fan and all accessories: OFF
  - Transaxle: Neutral (P range on vehicles with A/T)
2. Turn the ignition switch off and connect the scan tool to the data link connector.
3. Check that the basic ignition timing is within the standard value.

**Standard value: 5° BTDC ± 3°**

4. Run the engine at idle for 2 minutes.
5. Check the curb idle speed. Select item No.22 and take a reading of the idle speed.

**Standard value: 700 ± 100 r/min****NOTE**

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

6. If the idle speed is not within the standard value, check the MFI components by referring to GROUP 13A - Troubleshooting.

### IDLE MIXTURE CHECK

11100210258

1. Before inspection, set the vehicle in the following condition.
  - Engine coolant temperature: 80 - 95°C (176 - 203°F)
  - Lights, electric cooling fan and all accessories: OFF
  - Transaxle: Neutral (P range on vehicles with A/T)
2. Turn the ignition switch off and connect the scan tool to the data link connector.
3. Check that the basic ignition timing is within the standard value.

**Standard value: 5° BTDC ± 3°**

4. Run the engine at 2,500 r/min for 2 minutes.
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**

7. If the idle speed is not within the standard value, check the following items:
  - Diagnostic output
  - Closed-loop control (When the closed-loop control is carried out normally, the output signal of the heated oxygen sensor repeats between 0 - 400 mV and 600 - 1,000 mV at idle.)
  - Fuel pressure
  - Injector
  - Ignition coil, spark plug cable, spark plug
  - EGR system and the EGR valve leak
  - Evaporative emission control system
  - Compression pressure

#### NOTE

Replace the three-way catalyst whenever the CO and HC contents do not remain inside the standard value. (even though the result of the inspection is normal on all items).

**COMPRESSION PRESSURE CHECK**

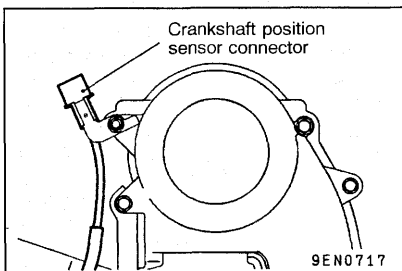
11100260680

1. Before inspection, set the vehicle in the following condition.
  - Engine coolant temperature: 80 - 95°C (176 - 203°F)
  - Lights, electric cooling fan and all accessories: OFF
  - Transaxle: Neutral (P range on vehicles with A/T)
2. Disconnect the spark plug cables.
3. Remove all of the spark plugs.

4. Disconnect the crankshaft position sensor connector.

**NOTE**

Doing this will prevent the engine module from carrying out ignition and fuel injection.



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

**Caution**

1. **Keep away from the spark plug hole when cranking.**
2. **If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.**

6. Set 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 300 r/min):**

**1,370 kPa (199 psi)**

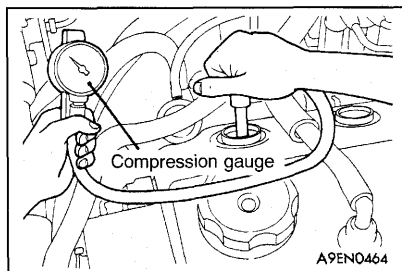
**Limit (at engine speed of 300 r/min):**

**min. 1,040 kPa (151 psi)**

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

**Limit: max. 100 kPa (14 psi)**

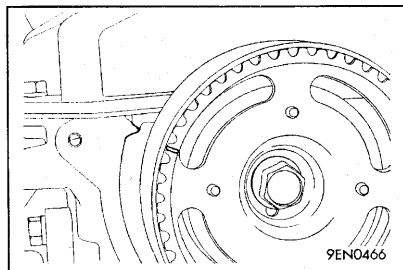
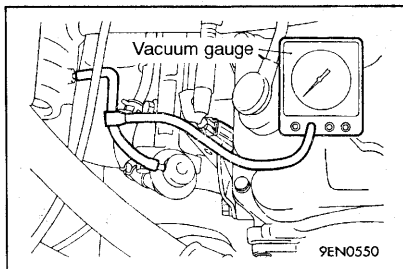
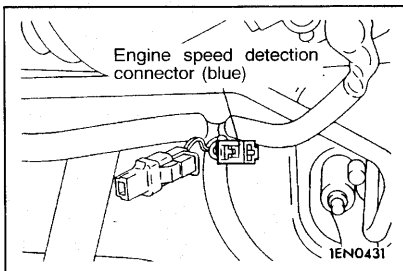
9. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps 7 and 8.
  - (1) If the compression increases after oil is added, the cause of the malfunction is a worn 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 spark plug cables.
12. Use the scan tool to erase the diagnostic trouble codes, or disconnect the negative battery cable for more than 10 seconds and reconnect it.

**NOTE**

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

**MANIFOLD VACUUM CHECK**

11100270263

1. Before inspection, set the vehicle in the following condition.
  - Engine coolant temperature: 80 - 95°C (176 - 203°F)
  - Lights, electric cooling fan and all accessories: OFF
  - Transaxle: Neutral (P range on vehicles with A/T)
2. Connect the scan tool to the data link connector, or connect a primary voltage detection type tachometer to the connector through a paper clip.

3. Attach a three-way joint to the vacuum hose connected between the intake manifold plenum and the fuel pressure regulator and connect a vacuum gauge.
4. Start the engine, and check that the curb idle speed is within the standard value range.

**Standard value: 700 ± 100 r/min**

5. Check the manifold vacuum.

**Limit: min. 60 kPa (18 in.Hg)**

**TIMING BELT TENSION ADJUSTMENT**

11100280129

1. Remove the timing belt upper cover.
2. Turn the crankshaft clockwise to set the No.1 cylinder to the top dead compression center.

**Caution**

**As the purpose of this procedure is to apply the proper amount of tension to the timing belt by means of the cam drive torque, be sure not to rotate the crankshaft counterclockwise.**

3. Remove the access cover.
4. Loosen the timing belt tensioner fixing bolt to apply tension to the belt by means of the force of the tensioner spring.

**Caution**

**The bolt can be loosened 90° - 180°. If the belt is loosened more than necessary, the bolt may fall inside the cover.**

5. Tighten the timing belt tensioner fixing bolt.
6. Install the access cover.
7. Install the timing belt upper cover.

**LASH ADJUSTER CHECK**

11100290436

If an abnormal noise (clicking) assumed to caused by a fault in the lash adjuster is heard and does not stop after the engine is started, inspect the following items.

**NOTE**

- (1) The abnormal noise caused by the lash adjuster occurs just after starting and fluctuates according to the engine speed, but is not related to the engine load.

Thus, if the abnormal noise does not occur just after the engine speed, if it does not fluctuate according to the engine speed, or if it fluctuates according to the engine load, the lash adjuster is not the cause of the abnormal noise.

- (2) If the lash adjuster is defective, often the abnormal noise will not stop even if warmup operation is continued in the idling state.

Note that the abnormal noise may stop only if the noise is caused by fixing of oil sludge in an engine where the oil control is poor.

1. Start the engine.
2. Check whether the abnormal noise starts immediately after starting, and whether it fluctuates according to the engine speed when the engine speed is varied.  
If the abnormal noise does not occur immediately after starting, or if it does not fluctuate according to the engine speed, the cause is not with the lash adjuster, so investigate for other causes of the abnormal noise. If the abnormal noise does not fluctuate according to the engine speed, it is assumed that the cause is not the engine unit. (In this case, the lash adjuster is normal.)
3. Check whether the abnormal noise level does not change when the engine load is fluctuated (ex., shift from N to D range) in the idling state.  
If the abnormal noise level fluctuates, this may be a hitting sound caused by wear of the crankshaft bearings or connecting rod bearings. (In this case, the lash adjuster is normal.)
4. Check for abnormal noise in the idling state after warmup operation is completed.  
If the abnormal noise is quieter or has stopped, it is assumed that the noise was caused by fixing of the lash adjuster due to oil sludge, etc., so wash the lash adjuster. (Refer to GROUP 11D - Rocker Arms and Camshaft.)  
If the abnormal noise level does not fluctuate, go to step 5.
5. Bleed the air from the lash adjuster. (Refer to GROUP 11C-14.)
6. If the abnormal noise does not stop even after purging the air, wash the lash adjuster. (Refer to GROUP 11D - Rocker Arms and Camshaft.)

## PURGING OF THE LASH ADJUSTER

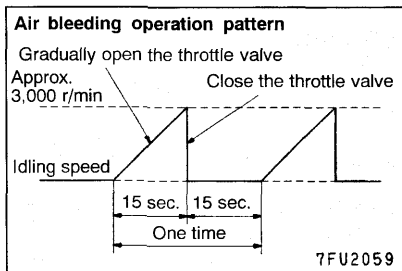
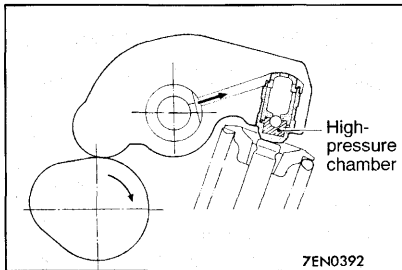
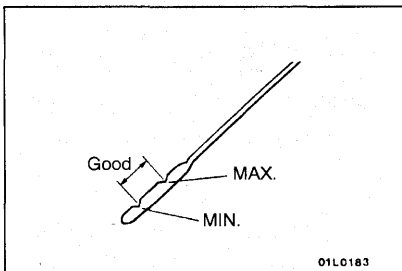
## NOTE

- (1) If the vehicle is parked for a long time on a slope, the oil in the lash adjuster will decrease, and air may enter the high pressure chamber when starting.
- (2) When the vehicle is parked for a long time, there will be no oil in the oil passage, and it will take time for the oil to be supplied to the lash adjuster. Thus, air may enter the high pressure chamber.
- (3) In the above cases, the abnormal noise can be stopped by purging the lash adjuster.

1. Check the engine oil level, and replenish or replace it if necessary.

## NOTE

- (1) If the engine oil level is low, air will be sucked in from the oil screen and will enter the oil passage.
- (2) If the engine oil level is higher than the specified amount, the oil will be mixed by the crankshaft and a large amount of air may enter the oil.
- (3) If the oil is deteriorated, the air and oil will not separate easily, and the amount of air in the oil will increase.
- (4) If due to the above types of cases, air enters the oil and into the high pressure chamber of the lash adjuster, the air in the high pressure chamber will be compressed too much when the valve is opened, so abnormal noise will occur when the valve is shut. This is the same phenomenon as when the valve clearance is excessive. In this case, the lash adjuster functions will return to normal if the air in the lash adjuster is bled out.



2. Carry out warmup operation for one to three minutes in the idling state.
3. Repeat the operation pattern shown on the left in a no-load state, and check for abnormal noise. (Normally, the abnormal noise will stop after the pattern is repeated for 10 to 30 times, but if the abnormal noise level does not change even when the pattern is repeated for 30 or more times, the cause may be other than the entry of air.
4. After the abnormal noise stops, repeat the operation pattern shown on the left for another five times.
5. For one to three minutes in the idling state, check that the abnormal noise has stopped.

## ENGINE ASSEMBLY

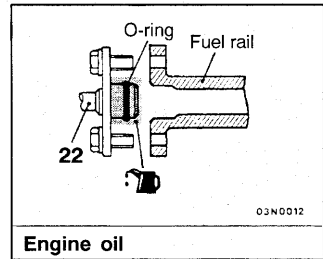
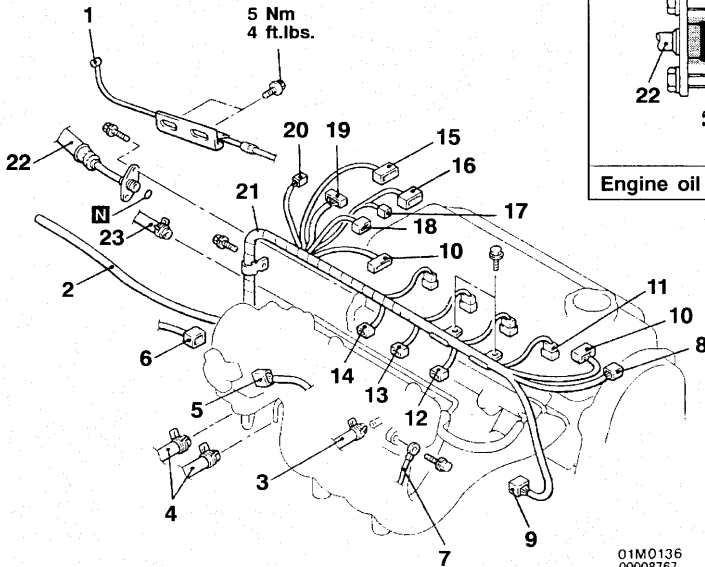
## REMOVAL AND INSTALLATION

**Pre-removal Operation**

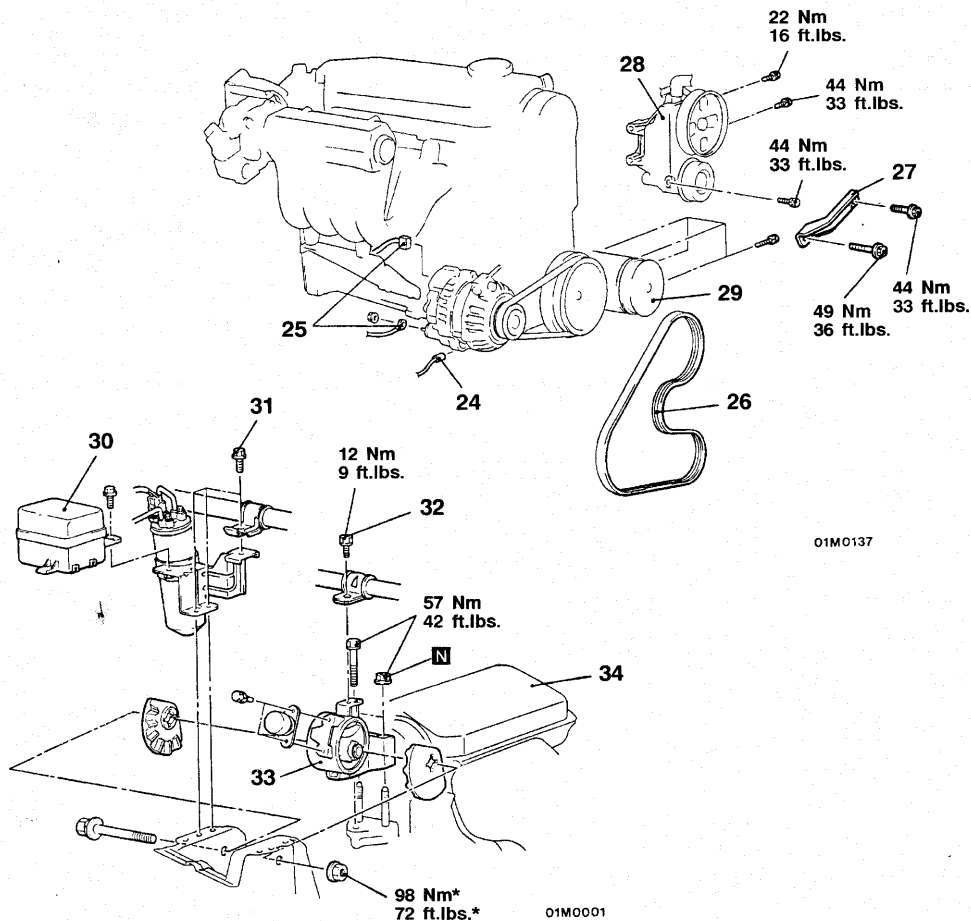
- (1) Fuel Discharge Prevention (Refer to GROUP 13A - On-vehicle Service.)
- (2) Under Cover Removal
- (3) Hood Removal (Refer to GROUP 42.)
- (4) Air Cleaner Removal
- (5) Radiator Removal (Refer to GROUP 14.)
- (6) Front Exhaust Pipe Removal (Refer to GROUP 15.)
- (7) Auto-cruise Vacuum Pump and Bracket Assembly Removal (Refer to GROUP 17.)

**Post-installation Operation**

- (1) Auto-cruise Vacuum Pump and Bracket Assembly Installation (Refer to GROUP 17.)
- (2) Front Exhaust Pipe Installation (Refer to GROUP 15.)
- (3) Radiator Installation (Refer to GROUP 14.)
- (4) Air Cleaner Installation
- (5) Hood Installation (Refer to GROUP 42.)
- (6) Under Cover Installation
- (7) Drive Belt Tension Adjustment
- (8) Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)

**Removal steps**

1. Accelerator cable connection
2. Vacuum hose connection
3. Brake booster vacuum hose connection
4. Heater hose connection
5. Throttle position sensor connector
6. Idle speed control connector
7. Ground cable connection
8. Crank angle sensor connector
9. Heated oxygen sensor connector
10. Ignition coil connector
11. Injector connector
12. Evaporative emission purge solenoid
13. EGR solenoid connector
14. Manifold differential pressure sensor connector
15. Heated oxygen sensor connector <Vehicle for California>
16. Ignition failure sensor connector
17. Engine coolant temperature gauge unit connector
18. Engine coolant temperature sensor connector
19. Camshaft position sensor connector
20. Noise condenser connector
21. Control wiring harness
22. High-pressure fuel hose connection
23. Fuel return hose connection



24. Oil pressure switch connector  
 25. Generator connector  
 26. Drive belt (Power steering and A/C)  
 27. Power steering pump bracket stay  
 28. Power steering oil pump and bracket assembly  
 29. Air conditioning compressor  
 • Transaxle assembly  
 30. Air conditioning relay box  
 31. Air conditioning receiver bracket mounting bolts

32. Power steering hose mounting bolt  
 33. Engine mount bracket  
 34. Engine assembly

**Caution**  
 Mounting locations marked by \* should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.





**REMOVAL SERVICE POINTS****◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL**

Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

**NOTE**

Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

**◀B▶ A/C COMPRESSOR REMOVAL**

Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

**NOTE**

Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

**◀C▶ TRANSAXLE ASSEMBLY REMOVAL****<M/T>:**

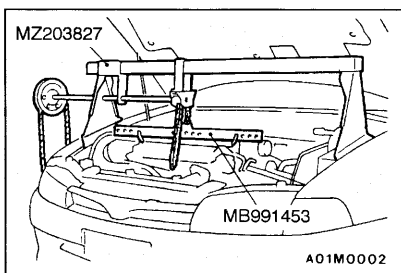
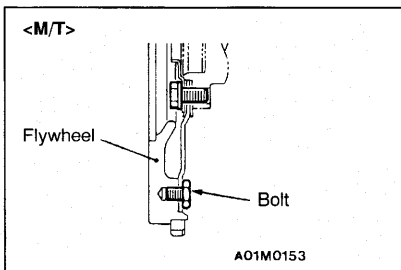
Refer to GROUP 22A.

**Caution**

**Do not remove the flywheel mounting bolt shown by the arrow. If this bolt is removed, the flywheel will become out of balance and damaged.**

**<A/T>:**

Refer to GROUP 23A.

**◀D▶ ENGINE MOUNT BRACKET REMOVAL**

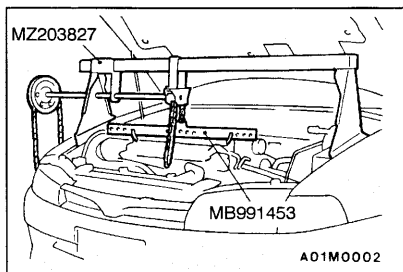
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transaxle assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so that the weight of the engine is no longer being applied to the engine mount bracket, and then remove the engine mount bracket.

**◀E▶ ENGINE ASSEMBLY REMOVAL**

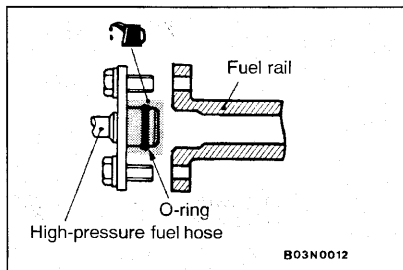
After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

**INSTALLATION SERVICE POINTS****▶A◀ ENGINE ASSEMBLY INSTALLATION**

Install the engine assembly, checking that the cables, hoses, and harness connectors are not pinched.

**▶B◀ ENGINE MOUNT BRACKET INSTALLATION**

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mount bracket while adjusting the position of the engine.
2. Support the engine with the garage jack.
3. Remove the chain block and support the engine assembly with the special tool.

**▶C◀ HIGH-PRESSURE FUEL HOSE INSTALLATION**

1. Apply a small amount of new engine oil to the O-ring.
 

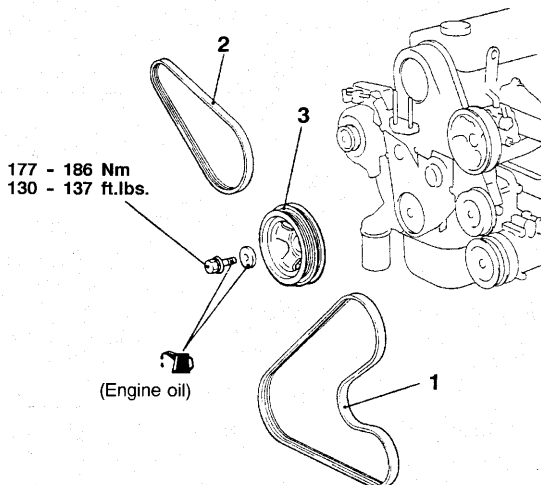
**Caution**  
Do not let any engine oil get into the fuel rail.
2. While turning the high-pressure fuel hose clockwise and counterclockwise, install it to the fuel rail, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably being pinched. Disconnect the high-pressure fuel hose and check the O-ring for damage. After this, re-insert the fuel rail and check that the hose turns smoothly.

**CRANKSHAFT PULLEY****REMOVAL AND INSTALLATION****Pre-removal Operation**

- Under Cover Removal

**Post-installation Operation**

- (1) Drive Belt Tension Adjustment
- (2) Under Cover Installation

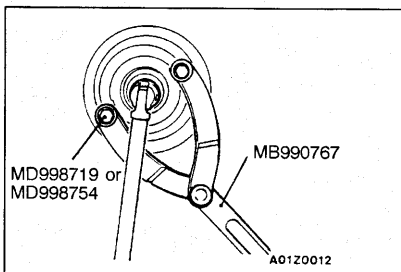


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**Removal steps**

1. Drive belt (Power steering and A/C)

2. Drive belt (Generator)
3. Crankshaft pulley

**REMOVAL SERVICE POINT**◀▶ **CRANKSHAFT PULLEY REMOVAL****INSTALLATION SERVICE POINT**▶▶ **CRANKSHAFT PULLEY INSTALLATION**

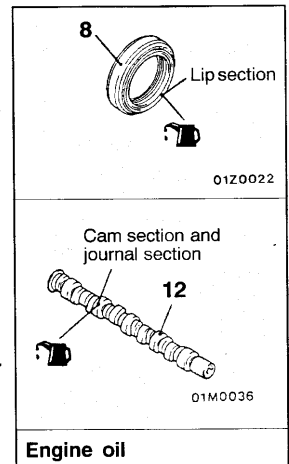
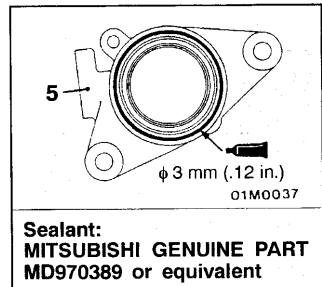
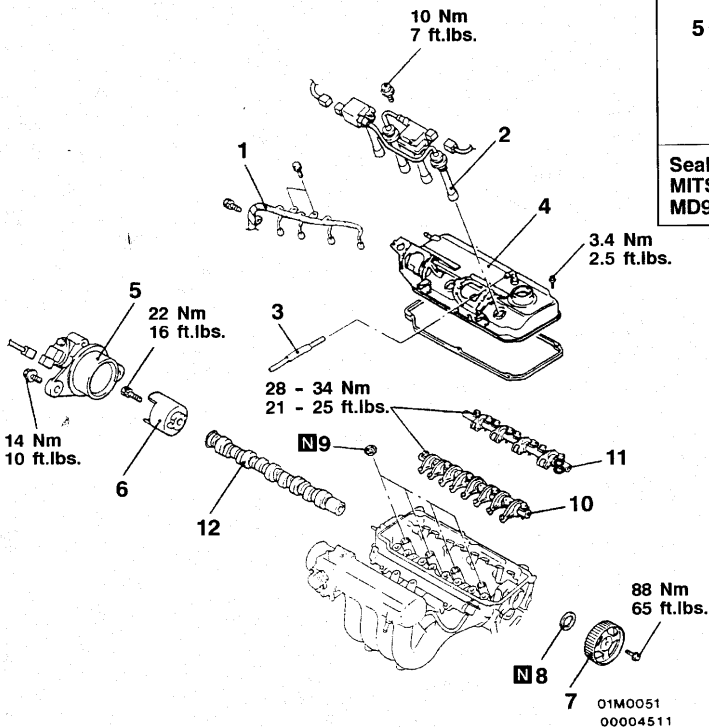
When installing the crankshaft bolt, apply a minimal amount of engine oil to the bearing surface and thread of the bolt.

## CAMSHAFT AND CAMSHAFT OIL SEAL

## REMOVAL AND INSTALLATION

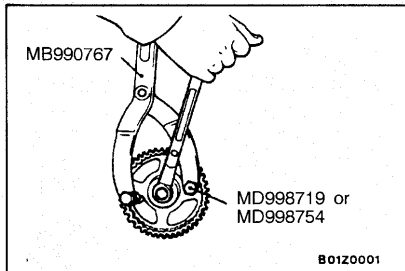
**Pre-removal and Post-installation Operation**

- (1) Air Cleaner Removal and Installation
- (2) Timing Belt Removal and Installation (Refer to P.11C-30.)

**Removal steps**

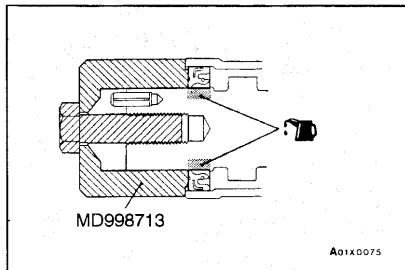
1. Control harness connection
2. Spark plug cable
3. PCV hose connection
4. Rocker cover
  - Valve clearance adjustment (Refer to GROUP 00 - Maintenance Service.)
5. Camshaft position sensor support
6. Camshaft position sensing cylinder

- ◀A▶ ▶B▶
- ▶A▶
7. Camshaft sprocket
  8. Camshaft oil seal
  9. Spark plug guide oil seal
  10. Rocker arm and shaft assembly (intake side)
  11. Rocker arm and shaft assembly (exhaust side)
  12. Camshaft



## REMOVAL SERVICE POINT

### ◀▶ CAMSHAFT SPROCKET REMOVAL



## INSTALLATION SERVICE POINTS

### ▶▶ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use the special tool to press-fit the camshaft oil seal.

### ▶▶ CAMSHAFT SPROCKET INSTALLATION

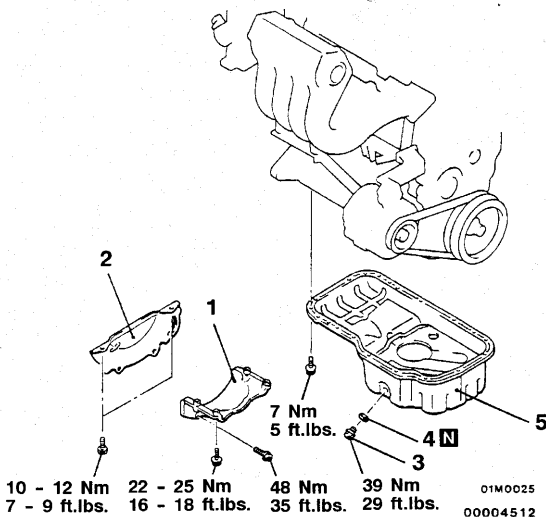
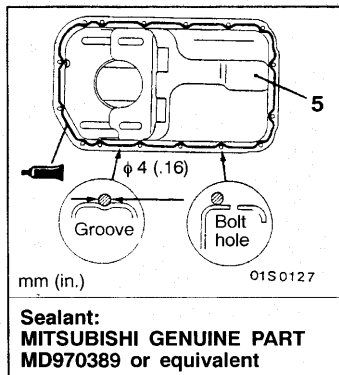
Use the special tool to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

# OIL PAN

## REMOVAL AND INSTALLATION

### Pre-removal and Post-installation Operation

- (1) Engine Oil Draining and Supplying (Refer to GROUP 00 - Maintenance Service.)
- (2) Oil Dipstick Removal and Installation
- (3) Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)



### Removal steps

1. Transaxle stay
2. Bell housing cover
3. Drain plug

- ◀A▶ 4. Drain plug gasket  
 ▶A◀ 5. Oil pan

### REMOVAL SERVICE POINT

#### ◀A▶ OIL PAN REMOVAL

After removing the oil pan mounting bolts, remove the oil pan with the special tool and a brass bar.

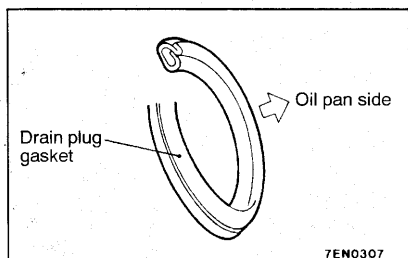
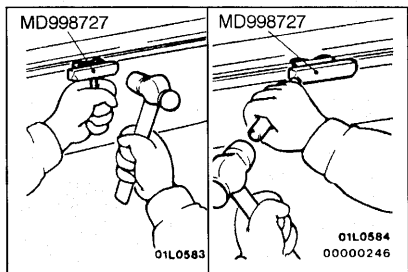
#### Caution

Perform this slowly to avoid deformation of the oil pan flange.

### INSTALLATION SERVICE POINT

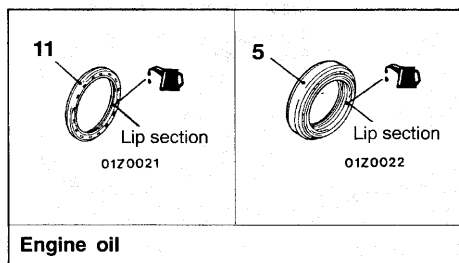
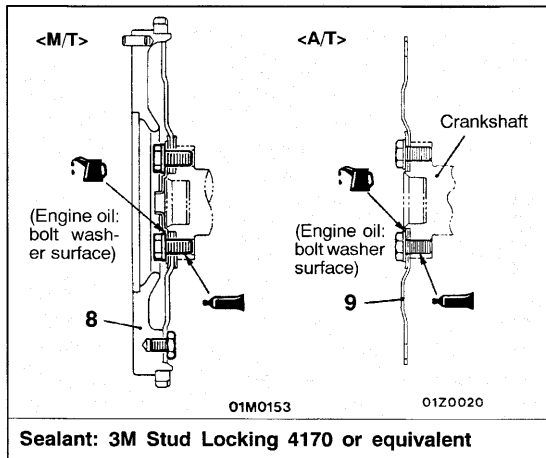
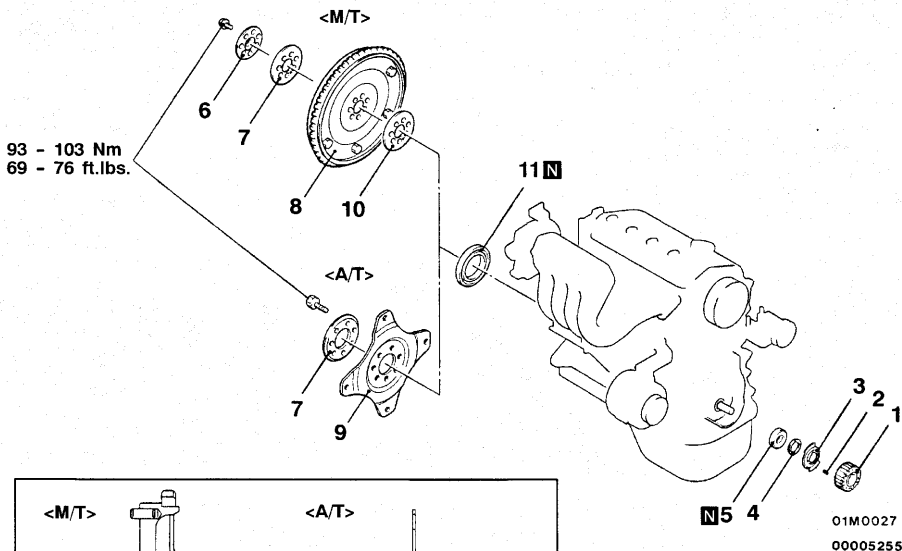
#### ▶A◀ DRAIN PLUG GASKET INSTALLATION

Install the drain plug gasket so it faces in the direction shown in the illustration.



# CRANKSHAFT OIL SEAL

## REMOVAL AND INSTALLATION



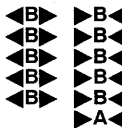
### Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11C-30.)
  - Crankshaft position sensor (Refer to GROUP 16.)
1. Crankshaft sprocket
  2. Key
  3. Crankshaft sensing blade
  4. Crankshaft spacer
  5. Crankshaft front oil seal



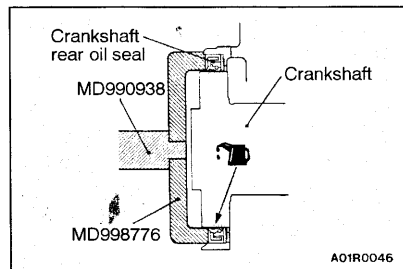
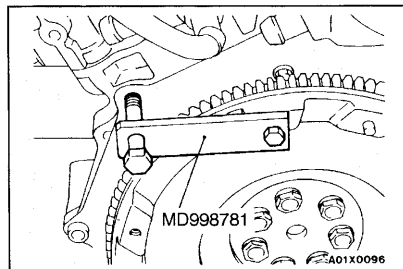
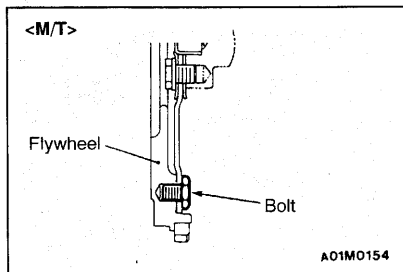
### Crankshaft rear oil seal removal steps

- Oil pan (Refer to P.11C-22.)
  - Transaxle assembly
  - Clutch cover and disc <M/T>
6. Plate <M/T>
  7. Adapter plate
  8. Flywheel <M/T>
  9. Drive plate <A/T>
  10. Adapter plate <M/T>
  11. Crankshaft rear oil seal



### Caution

Do not disassemble the flywheel, as its runout is adjusted as an assembly. If it is disassembled, the flywheel may lose the balance and get damage.



## REMOVAL SERVICE POINT

### ◀A▶ TRANSAXLE ASSEMBLY REMOVAL

<M/T>:

Refer to GROUP 22A.

#### Caution

Do not remove the flywheel mounting bolt shown by the arrow. If this bolt is removed, the flywheel will become out of balance and damaged.

<A/T>:

Refer to GROUP 23A.

### ◀B▶ PLATE <M/T>/ADAPTER PLATE/FLYWHEEL <M/T>/DRIVE PLATE <A/T> REMOVAL

Use the special tool to secure the flywheel or drive plate, and remove the bolts.

## INSTALLATION SERVICE POINTS

### ▶A▶ CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

### ▶B▶ DRIVE PLATE <A/T>/FLYWHEEL <M/T>/ADAPTER PLATE/PLATE <M/T> INSTALLATION

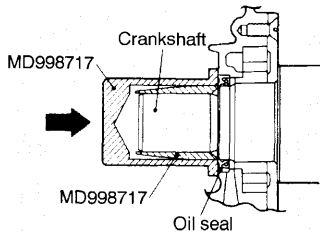
1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel or drive plate.
2. Apply oil to the bearing surface of the flywheel or drive plate bolts.
3. Apply oil to the crankshaft thread holes.
4. Apply sealant to the threaded mounting holes.

#### Specified sealant:

**3M Stud locking 4170 or equivalent**

5. Use the special tool to hold the flywheel or drive plate in the same manner as removal, and install the bolt.





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**▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION**

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap the oil seal until it is flush with the oil seal case.

## CYLINDER HEAD GASKET

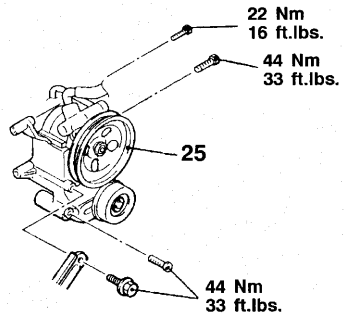
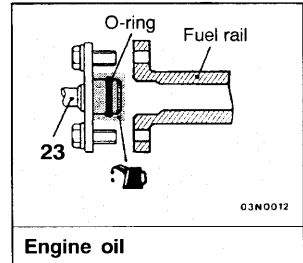
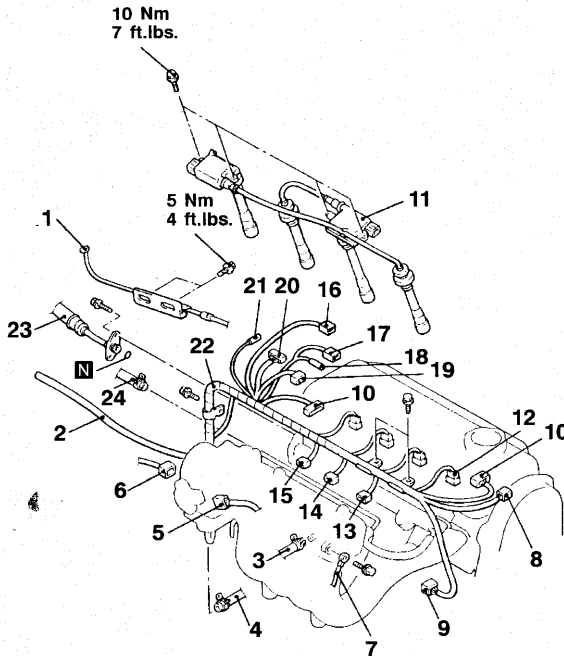
## REMOVAL AND INSTALLATION

**Pre-removal Operation**

- (1) Fuel Discharge Prevention (Refer to GROUP 13A - On-vehicle Service.)
- (2) Engine Oil Draining (Refer to GROUP 00 - Maintenance Service.)
- (3) Thermostat Case Assembly Removal (Refer to GROUP 14 - Water Hose and Water Pipe.)

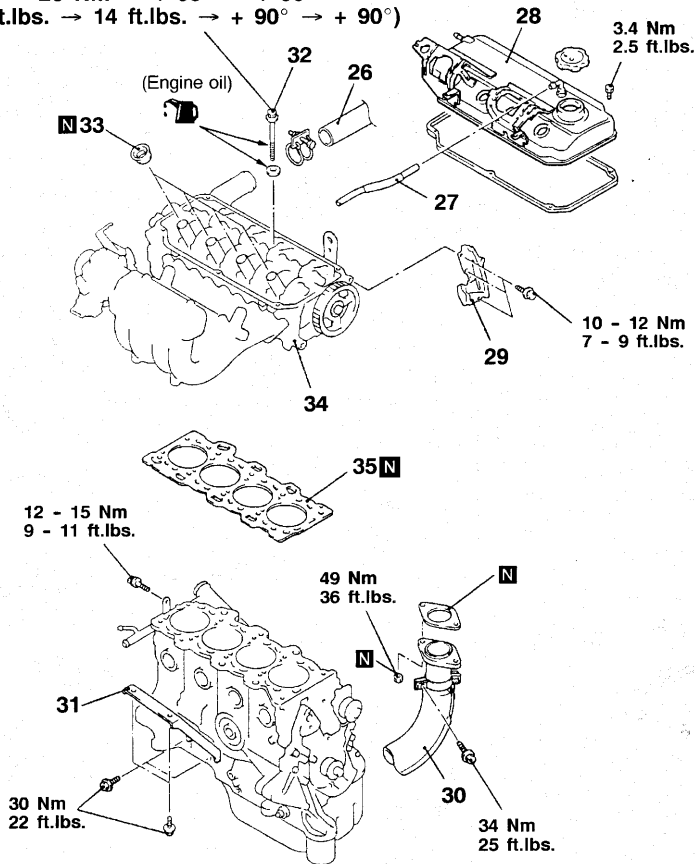
**Post-installation Operation**

- (1) Thermostat Case Assembly Installation (Refer to GROUP 14 - Water Hose and Water Pipe.)
- (2) Engine Oil Supplying (Refer to GROUP 00 - Maintenance Service.)
- (3) Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)

01M0138  
00008768**Removal steps**

1. Accelerator cable connection
2. Vacuum hose connection
3. Brake booster vacuum hose connection
4. Water hose connection
5. Throttle position sensor connector
6. Idle speed control connector
7. Ground cable connection
8. Crankshaft position sensor connector
9. Heated oxygen sensor connector
10. Ignition coil connector
11. Ignition coil assembly
12. Injector connector
13. Evaporative emission purge solenoid connector
14. EGR solenoid valve connector
15. Manifold differential pressure sensor connector
16. Heated oxygen sensor connector <Vehicles for California>
17. Ignition failure sensor connector
18. Engine coolant temperature gauge unit connector
19. Engine coolant temperature sensor connector
20. Camshaft position sensor connector
21. Noise condenser connector
22. Control wiring harness
23. High-pressure fuel hose connection
24. Fuel return hose connection
25. Power steering oil pump and bracket assembly

&lt;Cold engine&gt;

74 Nm → 0 Nm → 20 Nm → + 90° → + 90°  
(54 ft.lbs. → 0 ft.lbs. → 14 ft.lbs. → + 90° → + 90°)

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- ◀B▶ ▶C▶ 26. Radiator upper hose connection  
27. PCV hose  
28. Rocker cover  
● Timing belt (Refer to P.11C-30.)  
29. Timing belt rear cover  
30. Front exhaust pipe connection

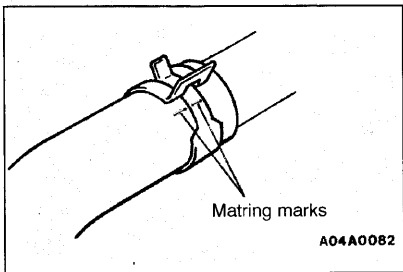
- ◀C▶ ▶B▶ 31. Intake manifold stay  
32. Cylinder head bolt  
33. Spark plug guide oil seal  
▶A▶ 34. Cylinder head assembly  
35. Cylinder head gasket

**REMOVAL SERVICE POINTS****◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL**

Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

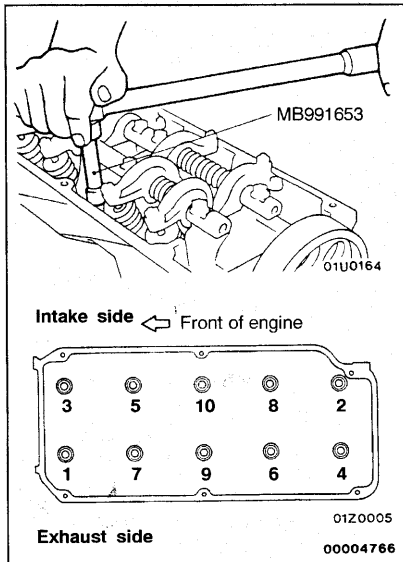
**NOTE**

Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the cylinder head assembly, and tie it with a cord.



### ◀B▶ RADIATOR UPPER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.



### ◀C▶ CYLINDER HEAD BOLT REMOVAL

Using the special tool, loosen the bolts in 2 or 3 steps in the order of the numbers shown in the illustration, and remove the cylinder head assembly.

#### Caution

Because the plug guides cannot be replaced by themselves, be careful not to damage or deform them when removing the cylinder head bolts.

## INSTALLATION SERVICE POINTS

### ▶A▶ CYLINDER HEAD GASKET INSTALLATION

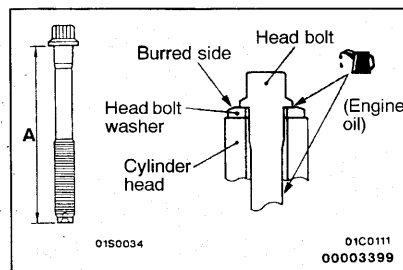
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the cylinder head holes match the respective cylinder head gasket holes.

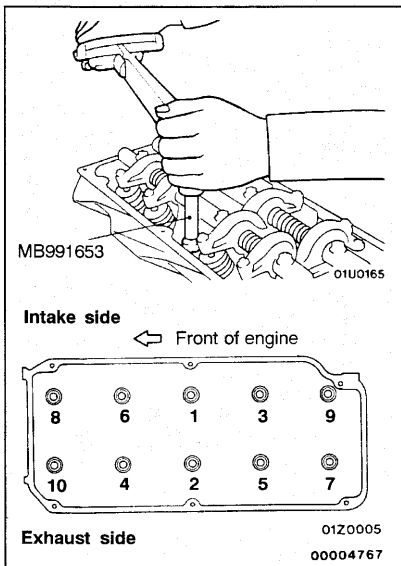
### ▶B▶ CYLINDER HEAD BOLT INSTALLATION

1. When installing the cylinder head bolts, the length below the head of the bolts should be within the limit. If it is outside the limit, replace the bolts.

**Limit (A): 96.4 mm (3.80 in.)**

2. The head bolt washer should be installed with the burred side, caused by tapping out, facing upwards.
3. Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.



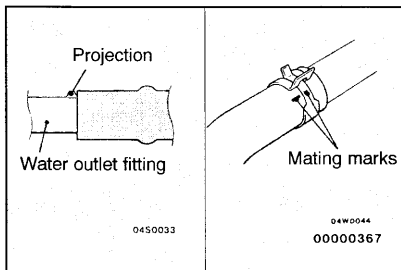
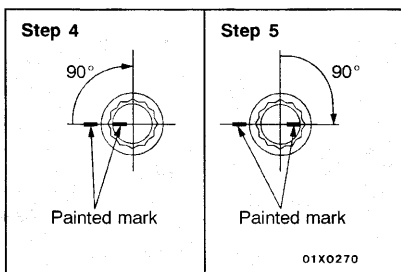


4. Using the special tool, tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 74 Nm (54 ft.lbs.).	In the order shown in the illustration.
2	Fully loosen.	In the reverse order of that shown in the illustration.
3	Tighten to 20 Nm (14 ft.lbs.).	In the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
5	Tighten 90° of a turn.	In the order shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

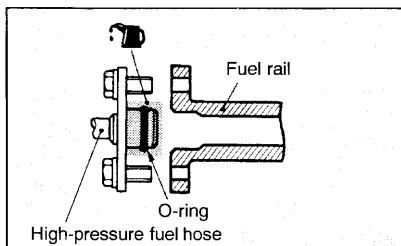
### Caution

1. Always make a tightening angle just 90°. If it is less than 90°, the head bolt will be loosened.
2. If it is more than 90°, remove the head bolt and repeat the procedure from step 1.



### ►◄ RADIATOR UPPER HOSE CONNECTION

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



### ►◄ HIGH-PRESSURE FUEL HOSE INSTALLATION

1. Apply a small amount of new engine oil to the O-ring.

#### Caution

Do not let any engine oil get into the fuel rail.

2. While turning the high-pressure fuel hose clockwise and counterclockwise, install the fuel rail, be careful not to damage the O-ring. After installing, check that the hose turns smoothly.

- If the hose does not turn smoothly, the O-ring is probably being pinched. Disconnect the high-pressure fuel hose and check the O-ring for damage. After this, re-insert the fuel rail and check that the hose turns smoothly.

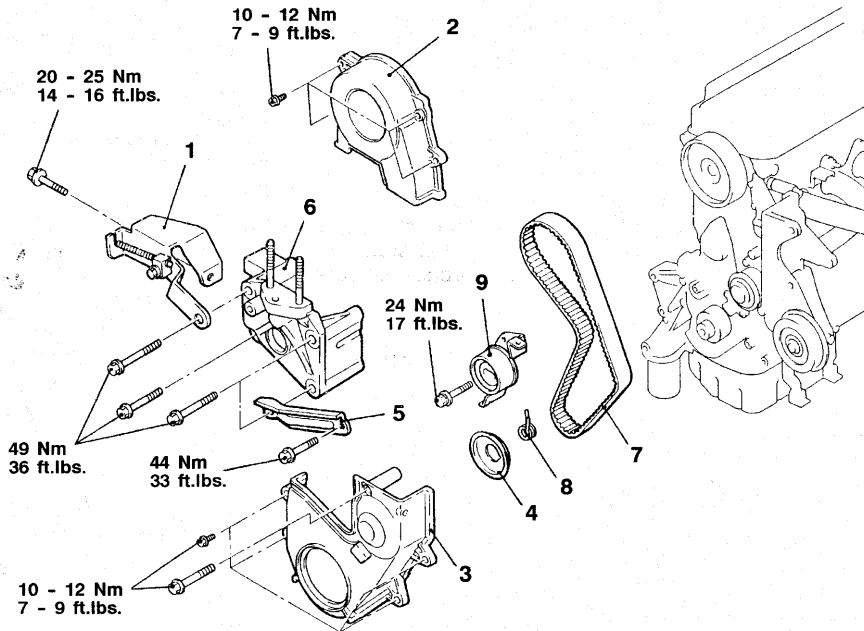
## TIMING BELT

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### REMOVAL AND INSTALLATION

#### Pre-removal and Post-installation Operation

- Crankshaft Pulley Removal and Installation  
(Refer to P.11C-19.)
- Engine Mount Bracket Removal and Installation  
(Refer to GROUP 32 - Engine Mounting.)



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#### Removal steps

- Generator brace
- Timing belt upper cover
- Timing belt lower cover
- Flange
- Power steering pump bracket stay



- Engine support bracket
- Timing belt tension adjustment
- Timing belt
- Tensioner spring
- Timing belt tensioner

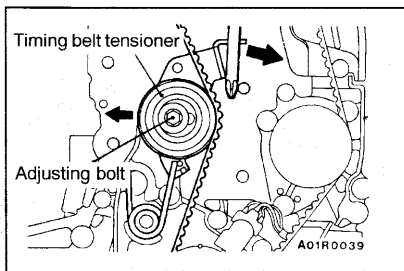
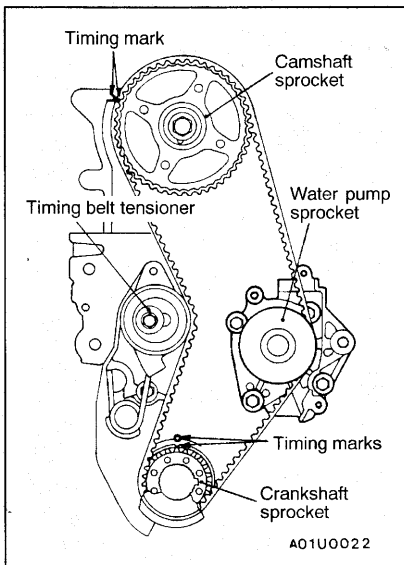
## REMOVAL SERVICE POINT

## ◀▶ TIMING BELT REMOVAL

1. Turn the crankshaft clockwise (right turn) to align each timing mark and to set the No. 1 cylinder at compression top dead center.

**Caution**

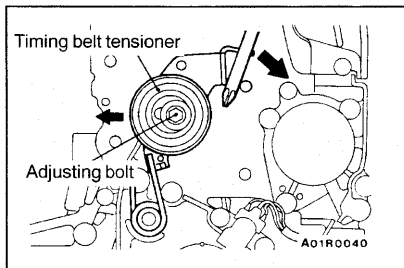
The crankshaft should always be turned only clockwise.



2. Loosen the adjusting bolt.
3. Set a screwdriver to the timing belt tensioner and press it fully back in the direction of the arrow.
4. Provisionally tighten the adjusting bolt.
5. Remove the timing belt.

**Caution**

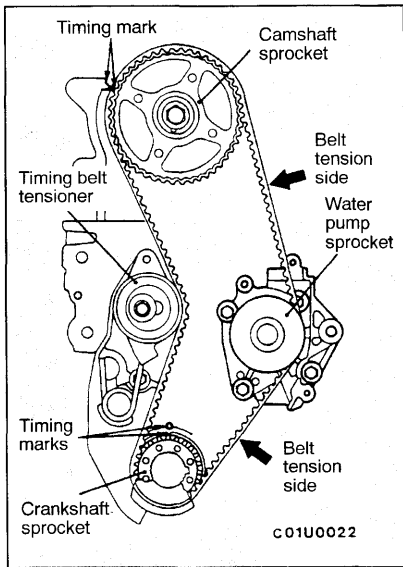
If the timing belt is to be re-used, use chalk to mark the flat side of the belt with an arrow indicating the direction of rotation (right turn).



## INSTALLATION SERVICE POINTS

## ▶◀ TIMING BELT INSTALLATION

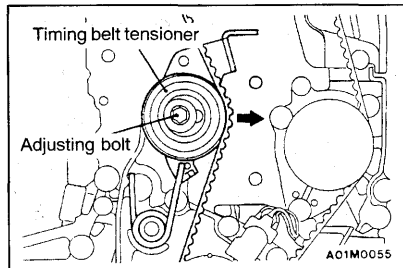
1. Set a screwdriver to the timing belt tensioner and press it fully back in the direction of the arrow.
2. Provisionally tighten the adjusting bolt.



3. Align each of the camshaft sprocket and the crankshaft sprocket timing marks.
4. Install the timing belt in the following order, while making sure that the tension side of the belt is not slackened.
  - (1) Crankshaft sprocket
  - (2) Water pump sprocket
  - (3) Camshaft sprocket
  - (4) Tensioner pulley

**Caution**

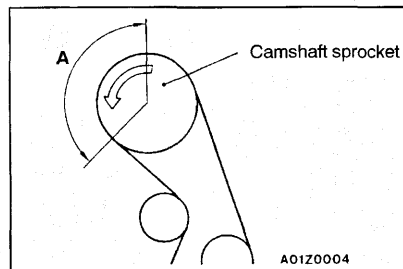
After installing the timing belt, apply force to turn the camshaft sprocket counterclockwise, and recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.

**►B◄ TIMING BELT TENSION ADJUSTMENT**

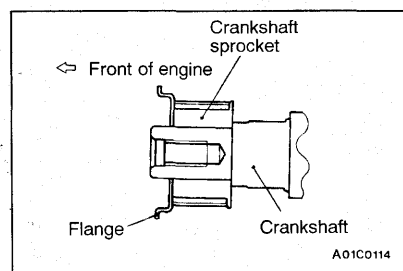
1. Loosen the adjusting bolt of the temporarily secured timing belt tensioner by 1/4 - 1/2 turn, and use the force of the tensioner spring to apply tension to the belt.
2. Turn the crankshaft clockwise for two rotations, and recheck to be sure that the timing marks on each sprocket are aligned.

**Caution**

As the purpose of this procedure is to apply the proper amount of tension to the tension side of the timing belt by using the cam driving torque, turn the crankshaft only by the amount given above. Be sure not to turn the crankshaft counterclockwise.



3. After checking to be sure that no belt teeth in the section marked with A are lifted up and that the teeth in each sprocket are engaged, secure the tensioner pulley.

**►C◄ FLANGE INSTALLATION**

Install the flange as shown in the illustration.