

# ENGINE

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11109000313

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**ENGINE OVERHAUL <1.8L> ..... 11D**

# ENGINE <1.5L>

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11109000726

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## GENERAL INFORMATION

11100010537

Items		Specifications	
Type		In-line, Overhead Camshaft	
Number of cylinders		4	
Bore mm (in.)		75.5 (2.97)	
Stroke mm (in.)		82.0 (3.23)	
Piston displacement cm <sup>3</sup> (cu.in.)		1,468 (86.6)	
Compression ratio		9.0	
Firing order		1-3-4-2	
Valve timing	Intake valve	Opens	BTDC 14°
		Closes	ABDC 48°
	Exhaust valve	Opens	BBDC 54°
		Closes	ATDC 10°
Lubrication		Pressurized feed-full filtration	

## SERVICE SPECIFICATIONS

11100030625

Items		Standard value	Limit
Generator drive belt vibration frequency Hz	When checked	150 - 184	-
	When a used belt is installed	159 - 176	-
	When a new belt is installed	191 - 218	-
Generator 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)	-
Generator drive belt deflection (Reference value) mm (in.)	When checked	8.7 - 11.4 (.34 - .45)	-
	When a used belt is installed	9.2 - 10.6 (.36 - .42)	-
	When a new belt is installed	6.6 - 8.3 (.26 - .33)	-
Power steering oil pump and A/C compressor drive belt vibration frequency Hz	When checked	137 - 168	-
	When a used belt is installed	145 - 160	-
	When a new belt is installed	174 - 199	-
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	9.6 - 12.4 (.38 - .49)	-
	When a used belt is installed	10.2 - 11.6 (.40 - .46)	-
	When a new belt is installed	7.2 - 9.0 (.28 - .36)	-
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)	-
A/C compressor drive belt deflection (Reference value) mm (in.)	When checked	4.6 - 6.2 (.18 - .24)	-
	When a used belt is installed	5.0 - 5.7 (.20 - .22)	-
	When a new belt is installed	3.4 - 4.3 (.13 - .17)	-
Basic ignition timing at idle		5° BTDC ± 3°	-
Actual ignition timing at curb idle		Approx. 10° 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)		1290 (188)	min. 920 (133)
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.)		-	103.2 (4.06)


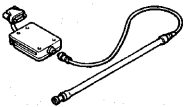
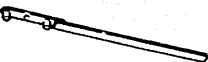
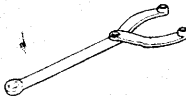
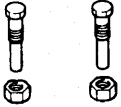
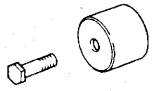

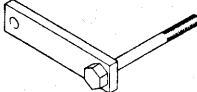
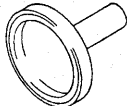
## SEALANT

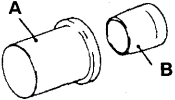
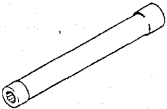
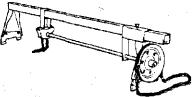

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Item	Specified sealant
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent

## SPECIAL TOOLS

11100060631

Tool	Tool number and name	Supersession	Application
 <p style="text-align: center;">B991502</p>	MB991502 Scan tool (MUT-II)	MB991496-OD	Checking the ignition timing Checking the idle speed
	MB991668 Belt tension meter set	Tool not available	Drive belt tension measurement
	MD998747 Crankshaft pulley holder	General service tool	Holding the crankshaft pulley
	MB990767 End yoke holder	MB990767-01	Holding the camshaft sprocket
	MD998719 or MD998754 Crankshaft pulley holder pin	MIT308239	Holding the camshaft sprocket
	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>
	MD998718 Crankshaft rear oil seal installer	MD998718-01	Press-in of the crankshaft rear oil seal

Tool	Tool number and name	Supersession	Application
 <p>A: MD998304 Crankshaft front oil seal installer B: MD998305 Crankshaft front oil seal guide</p>	<p>A: MD998304 Crankshaft front oil seal installer B: MD998305 Crankshaft front oil seal guide</p>	<p>A: MD998304-01 B: MD998305-01</p>	<p>Press-in of the crankshaft front oil seal</p>
	<p>MB991653 Cylinder head bolt wrench</p>	<p>General service tool</p>	<p>Removal and installation of the cylinder head bolt</p>
 <p>Z203827</p>	<p>GENERAL SERVICE TOOL MZ203827 Engine lifter</p>	<p>MZ203827-01</p>	<p>Supporting the engine assembly during removal and installation of the tranaxle</p>
 <p>B991453</p>	<p>MB991453 Engine hanger assembly</p>	<p>MZ203827-01</p>	

## TROUBLESHOOTING

11100070252

Symptom	Probable cause	Remedy
Compression too low	Cylinder head gasket blown	Replace gasket
	Piston ring worn or damage	Replace rings
	Piston or cylinder worn	Repair or replace piston and/or cylinder block
	Valve seat worn or damage	Repair or replace valve and/or seat ring
	Valve guide worn or damage	Replace valve guide
Oil pressure drop	Engine oil level too low	Check engine oil level
	Oil pressure switch faulty	Replace oil pressure switch
	Oil filter clogged	Install new filter
	Oil pump gears or cover worn	Replace gears and/or cover
	Thin or diluted engine oil	Change engine oil to correct viscosity
	Oil relief valve stuck (opened)	Repair relief valve
	Excessive bearing clearance	Replace bearings
Oil pressure too high	Oil relief valve stuck (closed)	Repair relief valve
Noisy valves	Malfunction of lash adjuster (Entry of air into the high pressure chamber, etc.)	Check the lash adjuster
	Thin or diluted engine oil (low oil pressure)	Change engine oil
	Valve stem or valve guide worn or damage	Replace valve and/or guide
Connecting rod noise/ main bearing noise	Insufficient oil supply	Check engine oil level
	Low oil pressure	Refer to "Oil pressure drop"
	Thin or diluted engine oil	Change engine oil
	Excessive bearing clearance	Replace bearings
Timing belt noise	Incorrect belt tension	Adjust belt tension and/or replace timing belt
Excessive engine rolling and vibration	Loose engine roll stopper (Front, Rear) Loose transaxle mount bracket Loose engine mount bracket Loose center member	Retighten
	Broken transaxle mount insulator Broken engine mount insulator Broken engine roll stopper insulator	Replace

## ON-VEHICLE SERVICE

11100090562

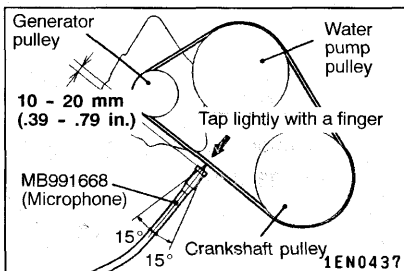
## DRIVE BELT TENSION CHECK AND ADJUSTMENT

## GENERATOR DRIVE BELT TENSION CHECK

Check drive belt tension in one of the following procedures.

## Standard value:

Vibration frequency Hz	150 - 184
Tension N (lbs.)	392 - 588 (88 - 132)
Deflection (Reference value) mm (in.)	8.7 - 11.4 (.34 - .45)



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

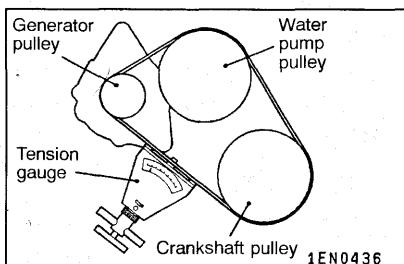
1. Connect the belt tension meter set (special tool) to the scan tool (MUT-II).
2. Connect the scan tool (MUT-II) to the diagnosis connector.
3. Turn the ignition switch to "ON" and select "Belt Tension Measurement" on the menu screen.
4. Hold the microphone to the middle of the drive belt between the 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;

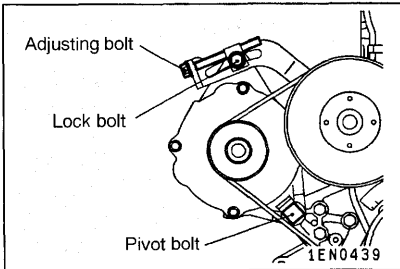
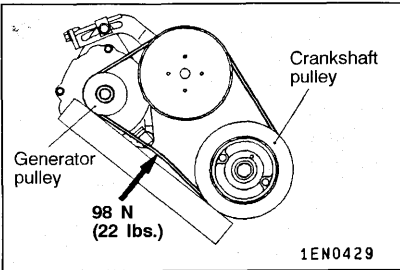
Use a belt tension gauge to check that the belt tension is within the standard value range.





## &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	159 - 176	191 - 218
Tension N (lbs.)	441 - 539 (99 - 121)	637 - 833 (143 - 187)
Deflection (Reference value) mm (in.)	9.2 - 10.6 (.36 - .42)	6.6 - 8.3 (.26 - .33)

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

## &lt;Vehicles with power steering&gt;

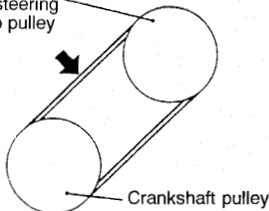
11100130196

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

## Standard value:

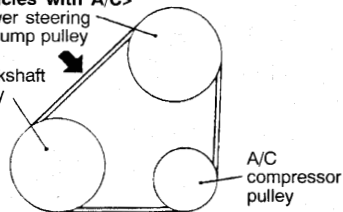
Items	When checked	When a used belt is intalled	When a new belt is installed
Vibration frequency Hz	137 - 168	145 - 160	174 - 199
Tension N (lbs.)	392 - 588 (88 - 132)	441 - 539 (99 - 121)	637 - 833 (143 - 187)
Deflection (Reference value) mm (in.)	9.6 - 12.4 (.38 - .49)	10.2 - 11.6 (.40 - .46)	7.2 - 9.0 (.28 - .35)

## &lt;Vehicles without A/C&gt;

Power steering  
oil pump pulley

A01M0020

## &lt;Vehicles with A/C&gt;

Power steering  
oil pump pulleyCrankshaft  
pulleyA/C  
compressor  
pulley

A01M0021

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

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 P.00-35.)

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

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).

## &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.

2. If the tension or deflection is outside the standard value, adjust by the following procedure.

- (1) Loosen power steering oil pump fixing bolts A, B and C.
- (2) Adjust the amount of belt deflection using adjusting bolt D.
- (3) Tighten fixing bolts A, B and C.

## Tightening torque:

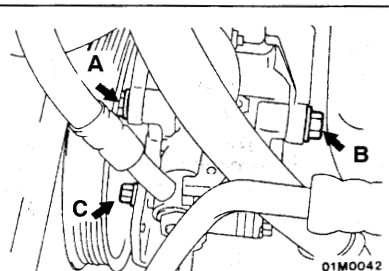
Bolts A and B: 39 Nm (29 ft.lbs.)

Bolt C: 49 Nm (36 ft.lbs.)

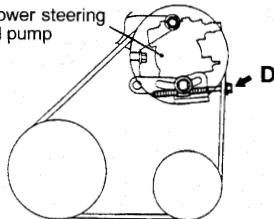
- (4) Check the belt deflection amount and tension, and readjust if necessary.

## Caution

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

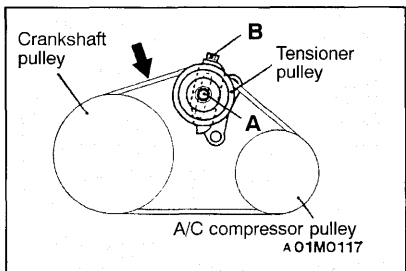


01M0042

Power steering  
oil pump

01M0033

00004503



## AIR CONDITIONING COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

<Vehicles without power steering>

11100100210

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	137 - 168	145 - 160	174 - 199
Tension N (lbs.)	392 - 588 (88 - 132)	441 - 539 (99 - 121)	637 - 833 (143 - 187)
Deflection (Reference value) mm (in.)	9.6 - 12.4 (.38 - .49)	10.2 - 11.6 (.40 - .46)	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 P.00-35.)

### <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 tension 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**

11100170143

1. Before inspection, set the vehicles 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. 10° BTDC****NOTE**

Ignition timing is variable within about ±7°, even under normal operating.

**CURB IDLE SPEED CHECK**

11100190538

1. Before inspection, set the vehicles 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**

11100210241

1. Before inspection, set the vehicles 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°**

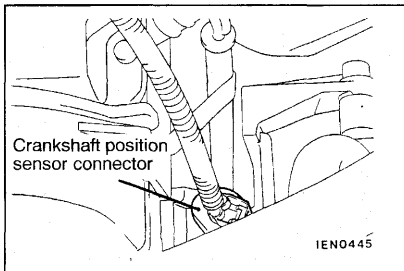
4. Run the engine at 2,500 r/min for 2 minutes.
5. Set the CO/HC tester.
6. Check the CO contents and the HC contents at idle.

**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

11100260673

- Before inspection, check that the engine oil, starter and battery are normal. Also, set the vehicle to 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)
- Disconnect the spark plug cables.
- Remove all of the spark plugs.
- Disconnect the crankshaft position sensor connector.

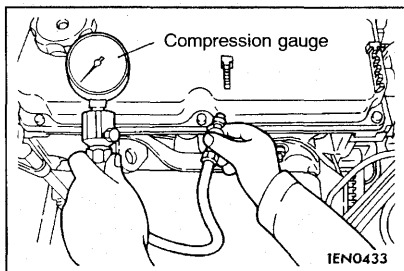
### NOTE

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

- 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

- Keep away from the spark plug hole when cranking.
- 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.



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

**Standard value (at engine speed of 300 r/min):**  
1,290 kPa (188 psi)

**Limit (at engine speed of 300 r/min):**  
min. 920 kPa (133 psi)

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

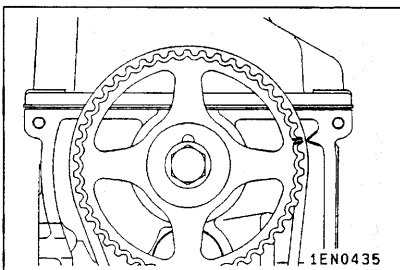
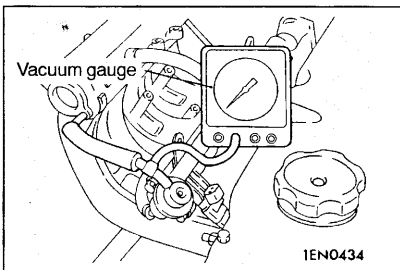
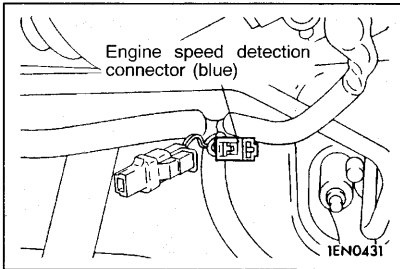
**Limit: max. 100 kPa (14 psi)**

- 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.
  - 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.
  - 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**

11100270256

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**

11100280112

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

11100290665

If an abnormal noise (clicking) assumed to be 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 11B - 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 11A-17.)
6. If the abnormal noise does not stop even after purging the air, wash the lash adjuster. (Refer to GROUP 11B - Rocker Arms and Camshaft.)



## PURGING OF THE LASH ADJUSTER

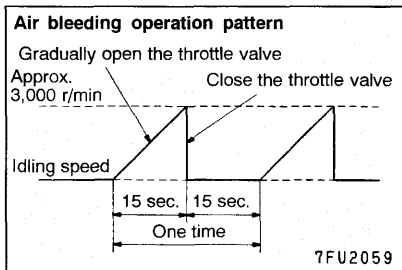
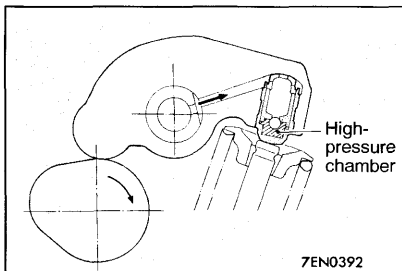
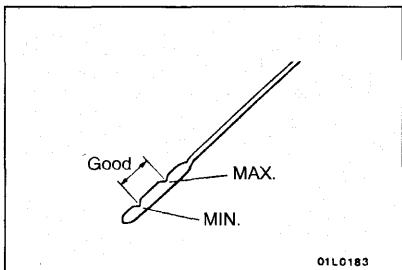
## NOTE

- (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, 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

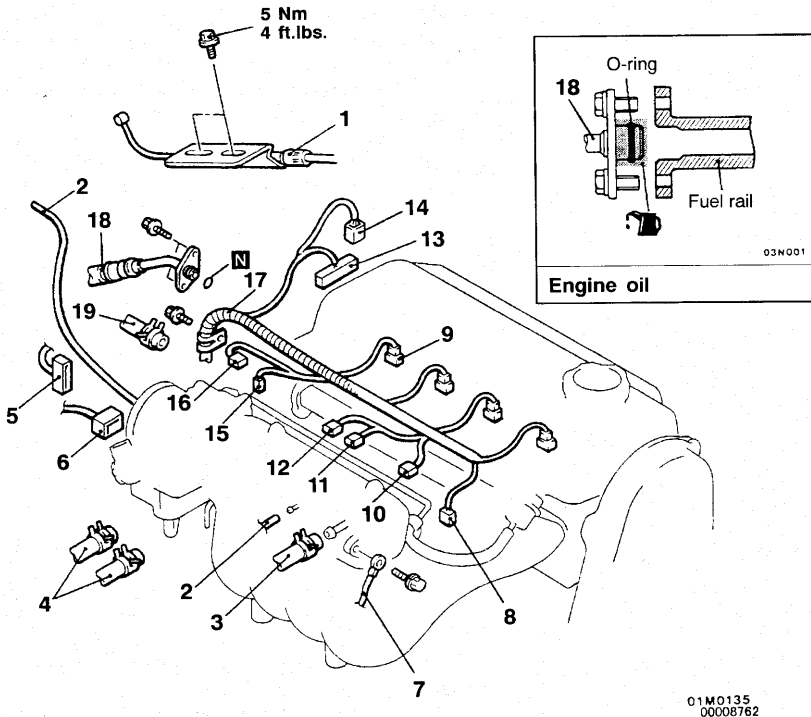
## REMOVAL AND INSTALLATION

**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.)

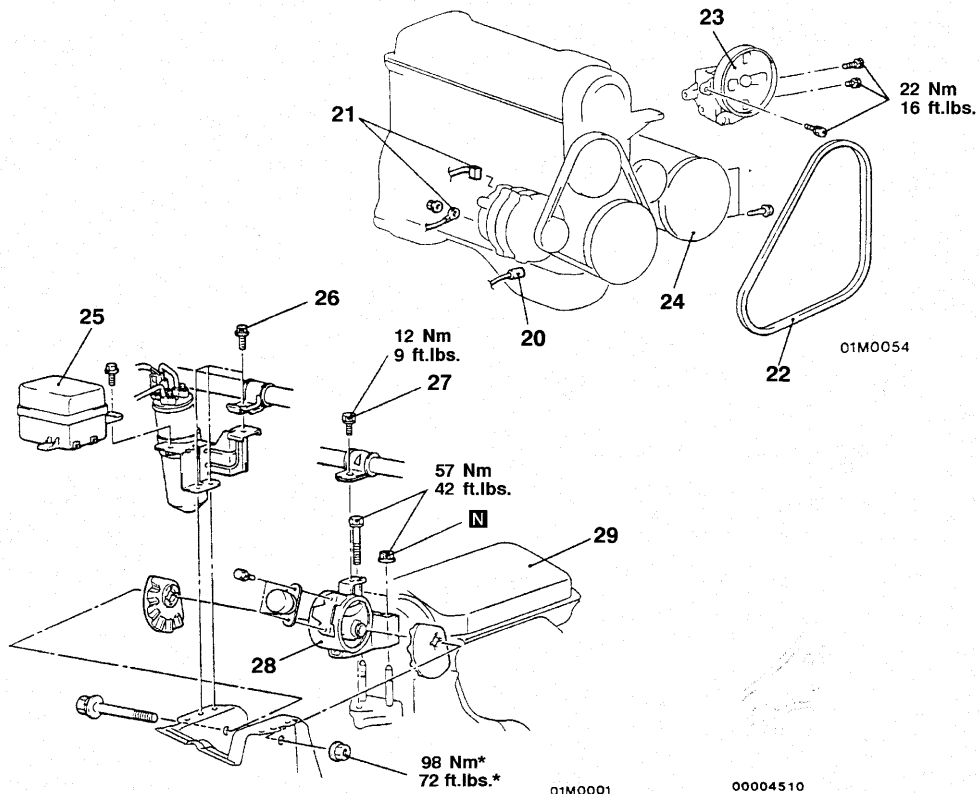
**Post-installation Operation**

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

**Removal steps**

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Accelerator cable connection</li> <li>2. Vacuum hose connection</li> <li>3. Brake booster vacuum hose connection</li> <li>4. Heater hose connection</li> <li>5. Throttle position sensor connector</li> <li>6. Idle speed control connector</li> <li>7. Ground cable connection</li> <li>8. Heated oxygen sensor connector</li> <li>9. Injector connector</li> <li>10. Intake air temperature sensor connector</li> <li>11. Evaporative emission purge solenoid connector</li> </ol> | <ol style="list-style-type: none"> <li>12. EGR solenoid connector</li> <li>13. Distributor connector</li> <li>14. Heated oxygen sensor connector<br/>&lt;Vehicles for California&gt;</li> <li>15. Engine coolant temperature gauge unit connector</li> <li>16. Engine coolant temperature sensor connector</li> <li>17. Control wiring harness</li> <li>18. High-pressure fuel hose connection</li> <li>19. Fuel return hose connection</li> </ol> |
|--|--|





20. Oil pressure switch connector  
 21. Generator connector  
 22. Drive belt

- (Power steering and A/C)  
 23. Power steering oil pump and bracket assembly

24. Air conditioning compressor  
 • Transaxle assembly

25. Air conditioning relay box  
 26. Air conditioning receiver bracket mounting bolts

27. Power steering hose mounting bolt

28. Engine mount bracket

29. 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.

◀A▶

◀B▶

◀C▶

**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>:

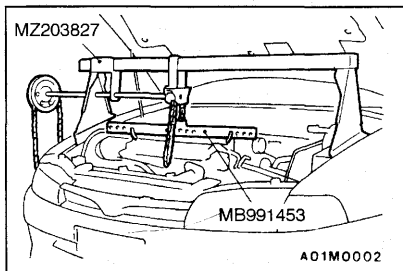
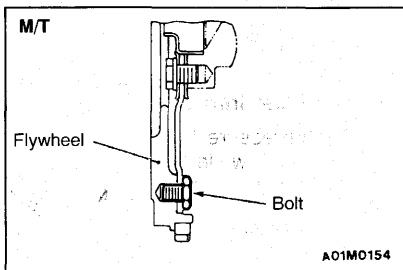
Refer to GROUP 22A.

**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**

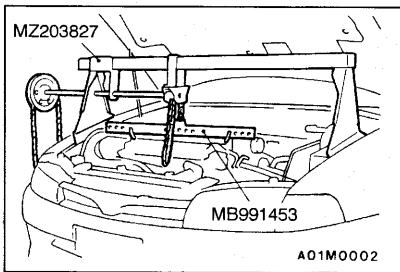
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transaxle assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so that 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**

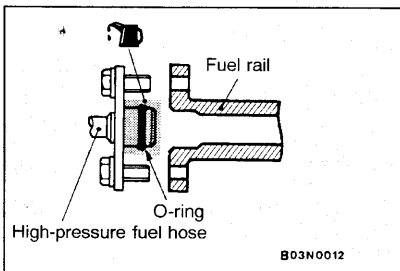
After checking that all cables, hoses and harness connectors, etc. are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

**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.**

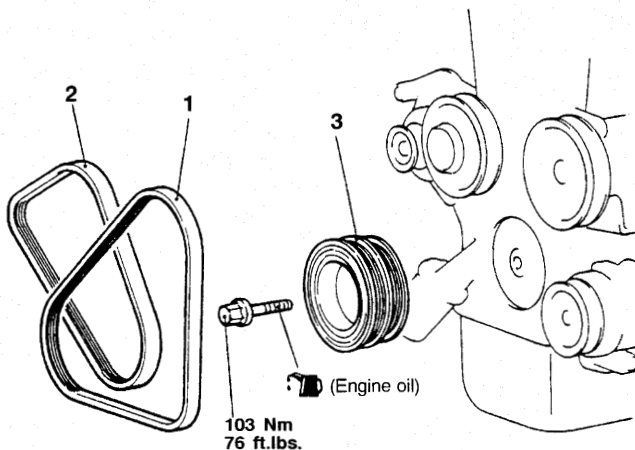
2. While turning the fuel high-pressure hose to the right and left, install it to the fuel rail, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably being pinched. Disconnect the high-pressure 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**

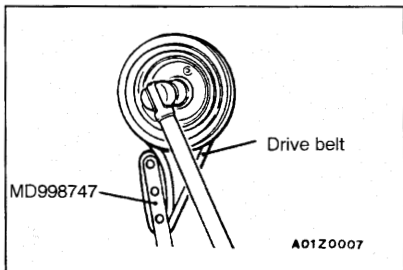
- (1) Drive Belt Tension Adjustment
- (2) Under Cover Installation



A01M0022

**Removal steps**

1. Drive belt  
(Power steering and A/C)
2. Drive belt (Generator)
3. Crankshaft pulley



A01Z0007

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

Use a drive belt, other than the engine's drive belt and special tool MD998747 to hold the rolling while removing the puller bolt.

**Caution**

1. This drive belt will get damaged. Do not use the engine's drive belt.
2. Never use a damaged drive belt.

**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.

**Caution**

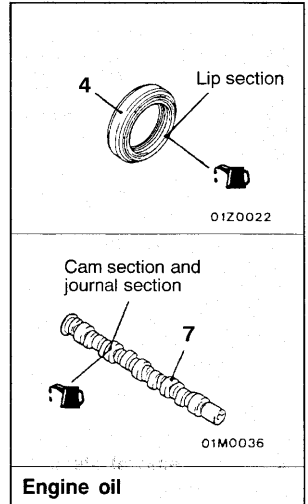
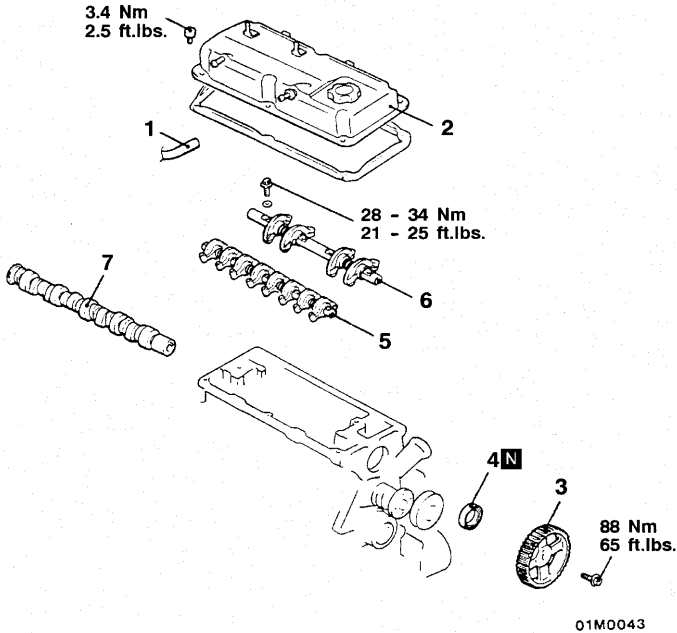
1. This drive belt will get damaged. Do not use the engine's drive belt.
2. Never use a damaged drive belt.

# CAMSHAFT AND CAMSHAFT OIL SEAL

## REMOVAL AND INSTALLATION

### Pre-removal and Post-installation Operation

- (1) Air Cleaner Removal and Installation
- (2) Distributor Removal and Installation  
(Refer to GROUP 16.)
- (3) Timing Belt Removal and Installation  
(Refer to P.11A-32.)



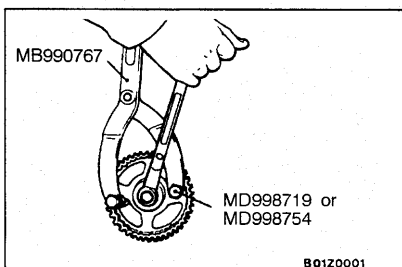
### Removal steps

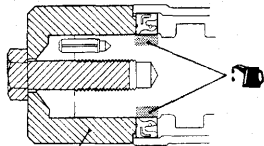
1. PCV hose connection
2. Rocker cover
3. Camshaft sprocket
4. Camshaft oil seal
5. Rocker arm and shaft assembly (intake side)
6. Rocker arm and shaft assembly (exhaust side)
7. Camshaft



### REMOVAL SERVICE POINT

#### ◀▶ CAMSHAFT SPROCKET REMOVAL





MD998713

A01X0075

## INSTALLATION SERVICE POINTS

### ▶A◀ 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.

### ▶B◀ 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.

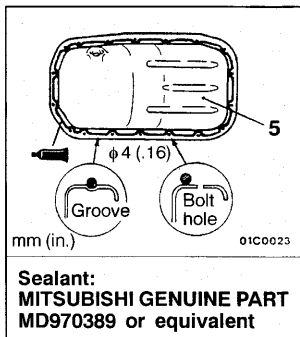


# OIL PAN

## REMOVAL AND INSTALLATION

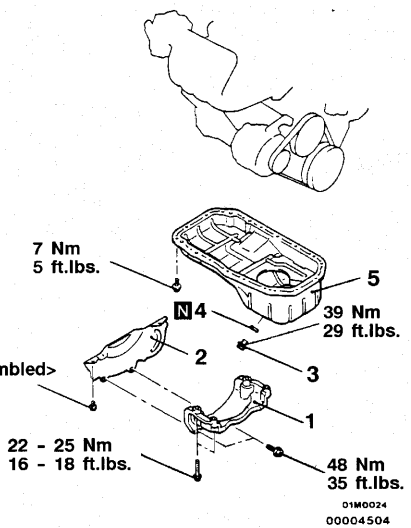
### Pre-removal and Post-installation Operation

- (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.)



<Bolt and washer assembled>  
9 Nm  
7 ft.lbs.

<Flange bolts>  
10 Nm  
7 ft.lbs.



### Removal steps

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

- ◀A▶ 4. Drain plug gasket  
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.

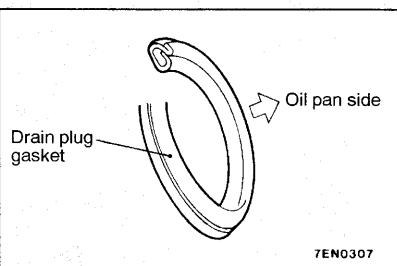
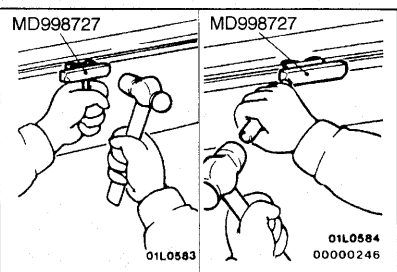
### Caution

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

## INSTALLATION SERVICE POINT

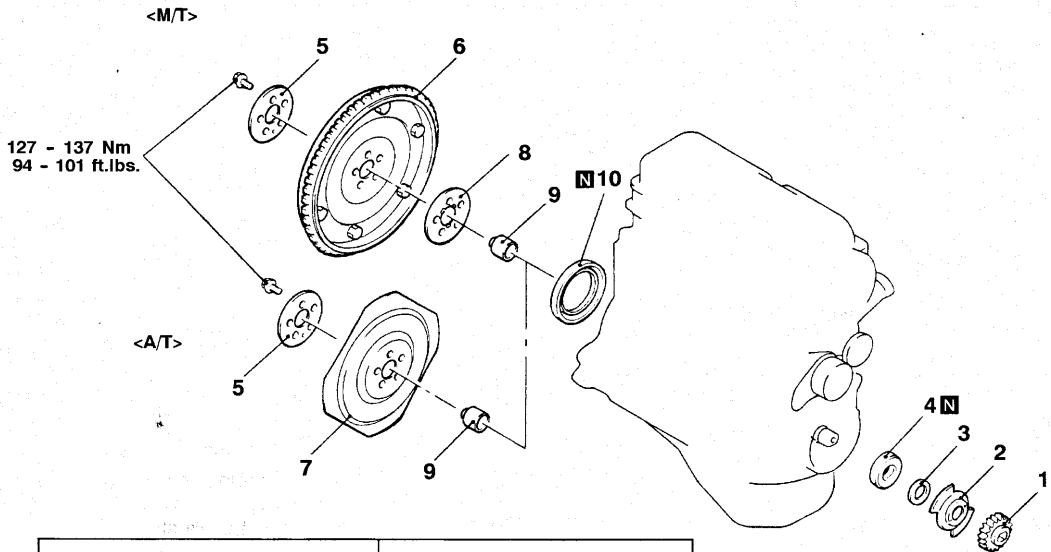
### ▶A◀ DRAIN PLUG GASKET INSTALLATION

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



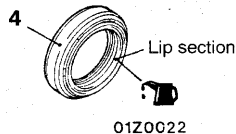
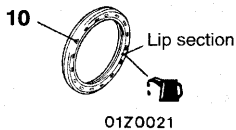
## CRANKSHAFT OIL SEAL

## REMOVAL AND INSTALLATION



01M0142

00004788



Engine oil

## Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11A-32.)
- 1. Crankshaft sprocket
- 2. Crankshaft sensing blade
- 3. Crankshaft spacer
- 4. Crankshaft front oil seal



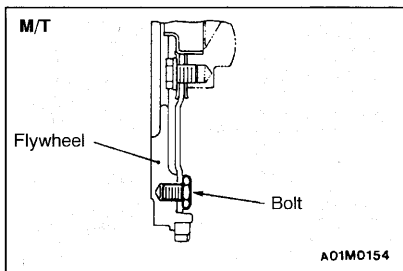
## Crankshaft rear oil seal removal steps

- Transaxle assembly
- Clutch cover and disc <M/T>
- 5. Adapter plate
- 6. Flywheel <M/T>
- 7. Drive plate <A/T>
- 8. Adapter plate <M/T>
- 9. Crankshaft bushing
- 10. 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**

&lt;M/T&gt;:

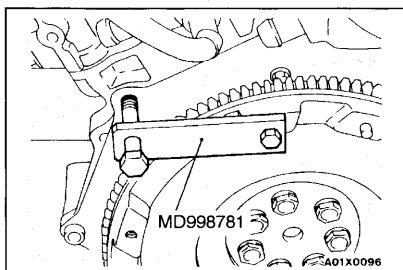
Refer to GROUP 22A.

**Caution**

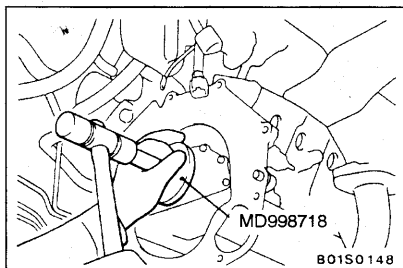
Do not remove the flywheel mounting bolt shown by the arrow. If this bolt is removed, the flywheel will become out of balance and damaged.

&lt;A/T&gt;:

Refer to GROUP 23A.

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

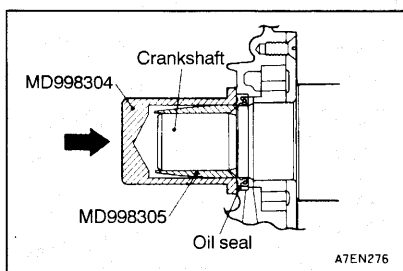
Use the special tool to secure the flywheel or drive plate, and remove the bolts.

**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. Tap in the oil seal as show in the illustration.

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

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

**▶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

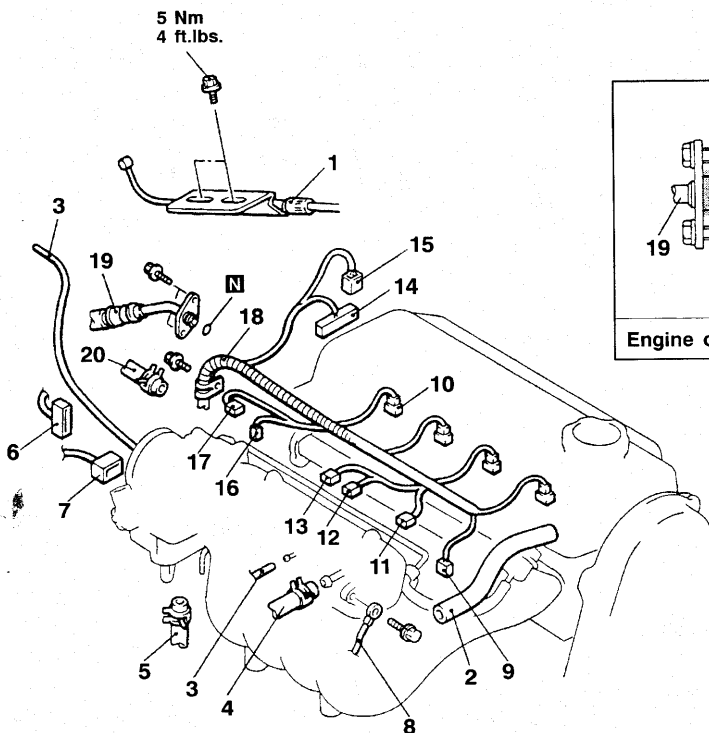
## REMOVAL AND INSTALLATION

**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.)



01M0134  
00008763

**Removal steps**

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Accelerator cable connection</li> <li>2. PCV hose</li> <li>3. Vacuum hose connection</li> <li>4. Brake booster vacuum hose connection</li> <li>5. Water hose connection</li> <li>6. Throttle position sensor connector</li> <li>7. Idle speed control connector</li> <li>8. Ground cable connection</li> <li>9. Heated oxygen sensor connector</li> <li>10. Injector connector</li> <li>11. Intake air temperature sensor connector</li> </ol> | <ol style="list-style-type: none"> <li>12. Evaporative emission purge solenoid connector</li> <li>13. EGR solenoid connector</li> <li>14. Distributor connector</li> <li>15. Heated oxygen sensor connector<br/>&lt;Vehicle for California&gt;</li> <li>16. Engine coolant temperature gauge unit connector</li> <li>17. Engine coolant temperature sensor connector</li> <li>18. Control wiring harness</li> <li>19. High-pressure fuel hose connection</li> <li>20. Fuel return hose connection</li> </ol> |
|--|--|

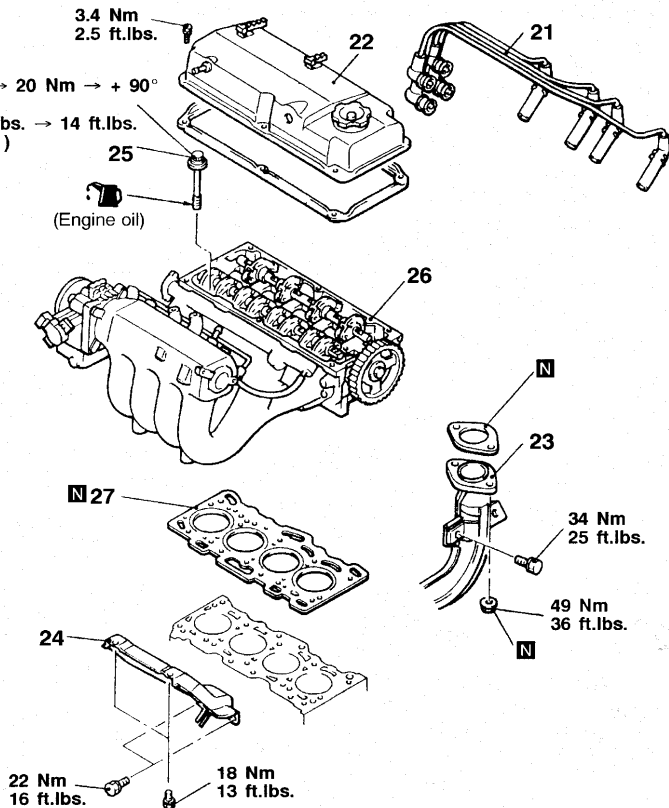
<Cold engine>

49 Nm → 0 Nm → 20 Nm → + 90°

→ + 90°

(36 ft.lbs. → 0 ft.lbs. → 14 ft.lbs.

→ + 90° → + 90° )



A01M0036

21. Spark plug cables

22. Rocker cover

● Timing belt (Refer to P.11A-32.)

23. Front exhaust pipe connection



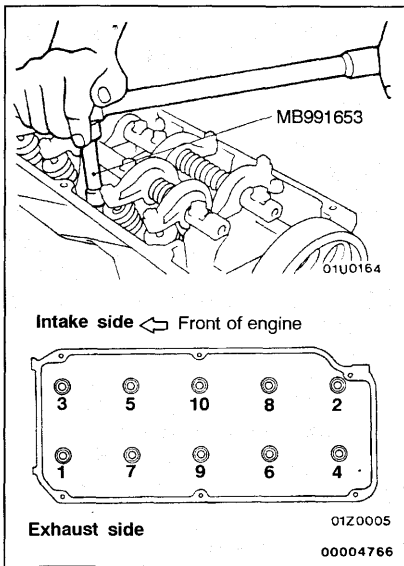
24. Intake manifold stay

25. Cylinder head bolts

26. Cylinder head



27. Cylinder head gasket



## REMOVAL SERVICE POINT

### ◀A▶ CYLINDER HEAD BOLT REMOVAL

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

## INSTALLATION SERVICE POINTS

### ▶A▶ CYLINDER HEAD GASKET INSTALLATION

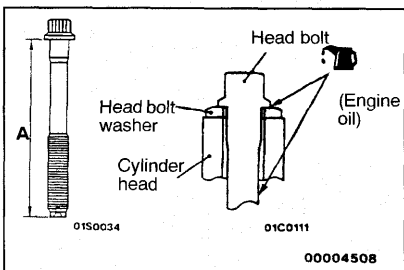
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the cylinder head holes match the respective cylinder head gasket holes.

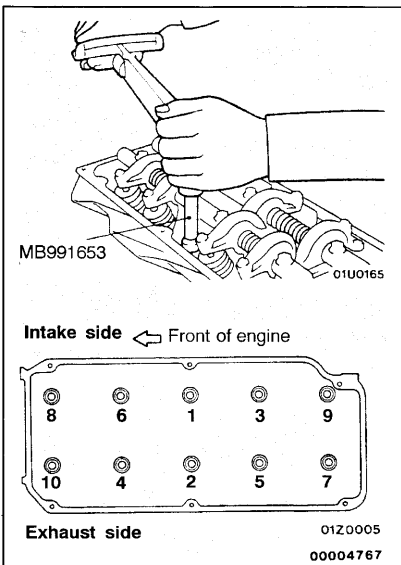
### ▶B▶ CYLINDER HEAD BOLT INSTALLATION

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): 103.2 mm (4.06 in.)**

2. The head bolt washer should be installed with the burred side, caused by tapping out, facing upward.



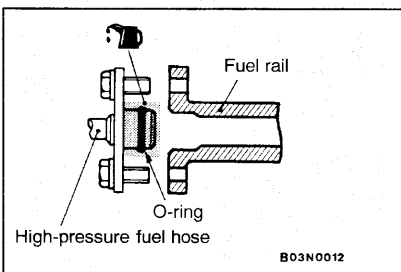
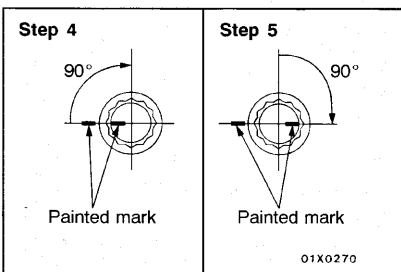


3. Using the special tool, tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 49 Nm (36 ft.lbs.)	Tighten in the order shown in the illustration.
2	Fully loosen.	Loosen in the reverse order of that shown in the illustration.
3	Tighten to 20 Nm (14 ft.lbs.)	Tighten 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 of just 90°. If it is less than 90°, the head bolt will loosen.
2. If it is more than 90°, remove the head bolt and repeat the procedure from step 1.



### ▶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.**

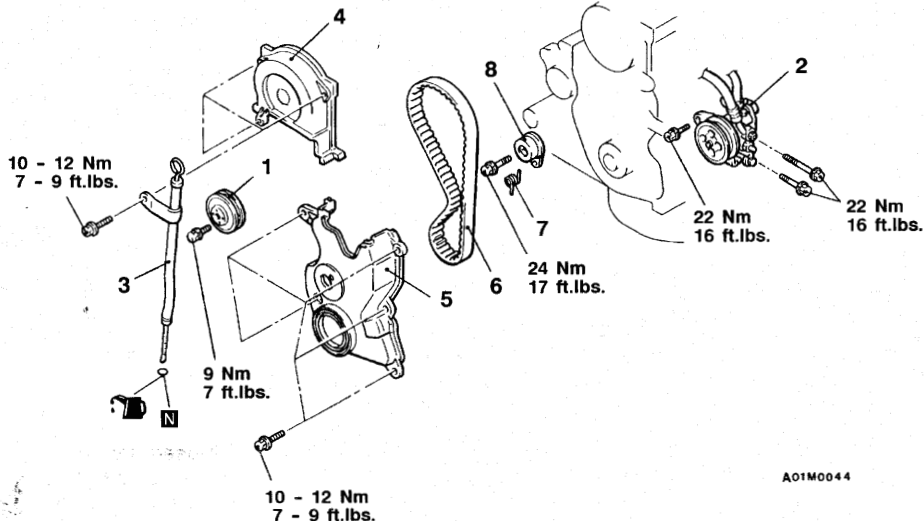
2. While turning the high-pressure fuel hose clockwise and counterclockwise, install fuel rail. Be careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably being clamped. Disconnect the high-pressure fuel hose and check the O-ring for damage. After this, re-insert the fuel rail and check that the hose turns smoothly.

## TIMING BELT

## REMOVAL AND INSTALLATION

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

- (1) Crankshaft Pulley Removal and Installation  
(Refer to P.11A-22.)
- (2) Engine Mount Bracket Removal and Installation  
(Refer to GROUP 32 - Engine Mounting.)



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**Removal steps**

1. Water pump pulley
2. Power steering oil pump and bracket assembly
3. Oil dipstick guide assembly
4. Timing belt upper cover

5. Timing belt lower cover
- Timing belt tension adjustment
6. Timing belt
7. Tensioner spring
8. Timing belt tensioner

**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 timing belt, and tie it with a cord.

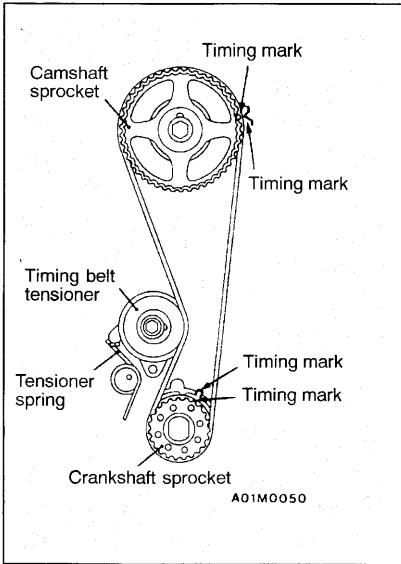


### ◀B▶ TIMING BELT REMOVAL

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

#### Caution

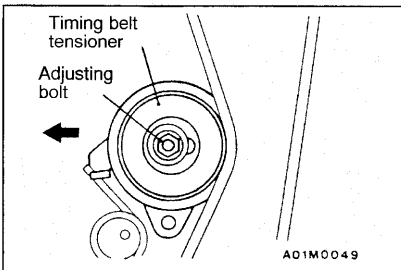
The crankshaft should always be turned only clockwise.



2. Loosen the adjusting bolt.
3. Move the timing belt tensioner to the water pump side and temporarily tighten the adjusting bolt so that the tensioner does not return.
4. Remove the timing belt.

#### Caution

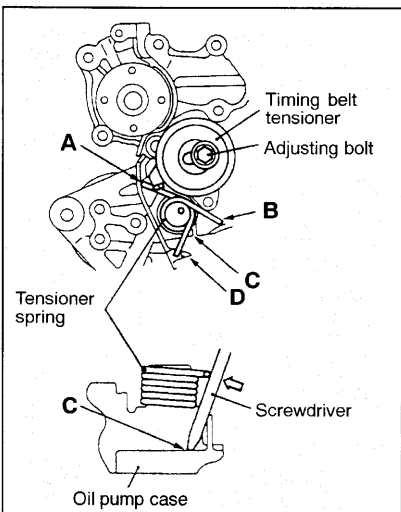
If the timing belt is to be re-used, use chalk to mark the flat side of the belt with an arrow indicating the direction of rotation (right turn).

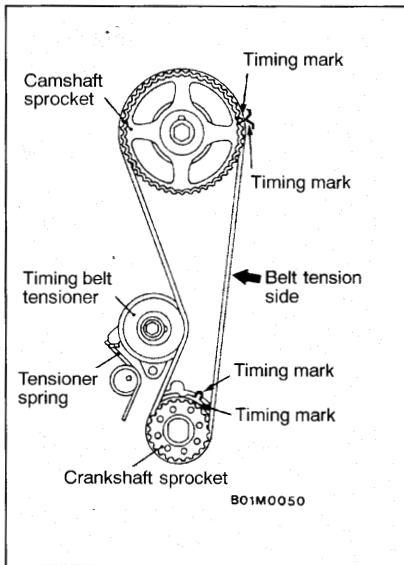


### INSTALLATION SERVICE POINTS

#### ▶A◀ TIMING BELT TENSIONER/TENSIONER SPRING/TIMING BELT INSTALLATION

1. Put the protrusion of the timing belt tensioner on the end (A) of the tensioner spring as shown.
2. Move the timing belt tensioner close to the water pump, and temporarily tighten the adjusting bolt.
3. Put a screwdriver in (C), push the protrusion (B) of the tensioner spring in the shown direction, and place it on the stopper (D) of the oil pump case.

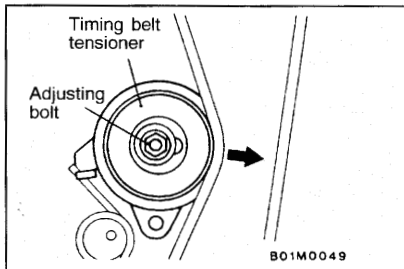




4. Align each of the camshaft sprocket and the crankshaft sprocket timing marks.
5. Install the timing belt in the following order, while making sure that the tension side of the belt is not slackened.
  - (1) Crankshaft sprocket
  - (2) Camshaft sprocket
  - (3) Tensioner pulley

#### Caution

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

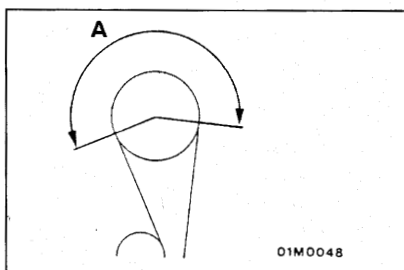


#### ►B◄ TIMING BELT TENSION ADJUSTMENT

1. Initially loosen the adjusting bolt of the timing belt tensioner fixed to the water pump side by 1/2 - 1/4 turn, and use the force of the tensioner spring to apply tension to the belt.
2. Turn the crankshaft in the proper rotation direction (right turn) 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 in the opposite direction (left turn).



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.