

# ENGINE <6G7>

Click on the applicable bookmark to selected the required model year.

# ENGINE <6G7>

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## GENERAL INFORMATION

Items		6G74-GDI	
Total displacement ml		3,497	
Bore × Stroke mm		93 × 85.8	
Compression ratio		10.4	
Combustion chamber		Pentroof + ball-in-piston	
Camshaft arrangement		DOHC	
Number of valve	Intake	12	
	Exhaust	12	
Valve timing	Intake	Opening	BTDC 8°
		Closing	ABDC 56°
	Exhaust	Opening	BBDC 48°
		Closing	ATDC 16°
Fuel system		Electronically controlled multipoint fuel injection	
Rocker arm		Roller type	
Auto-lash adjuster		Equipped	

## SERVICE SPECIFICATIONS

Items	Standard value	Limit
Basic ignition timing	5° BTDC ± 3°	-
Ignition timing	Approx. 20° BTDC*1	-
Idle speed r/min	600 ± 100*1	-
CO contents %	0.5 or less	-
HC contents ppm	100 or less	-
Compression pressure (at engine speed of 280 r/min) kPa	1,275	980
Compression pressure difference of all cylinders kPa	-	Max. 98
Intake manifold vacuum kPa	-	Min. 56*2
Auto tensioner rod depth (mm)	Within 1	-
Timing belt tension torque N·m	4.4	-
Auto-tensioner rod protrusion amount mm	3.8 - 5.0	-

### NOTE

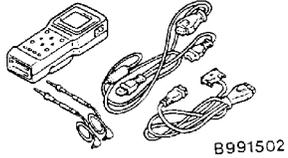
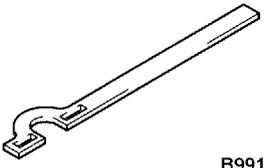
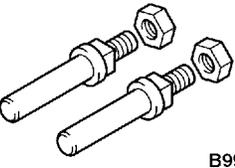
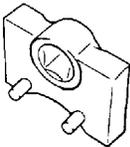
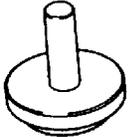
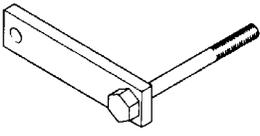
\*1: Indicates the value measured within 4 minutes since the engine was started.

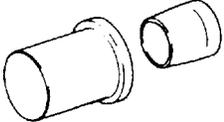
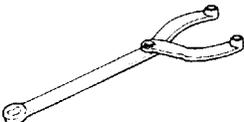
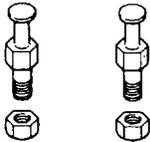
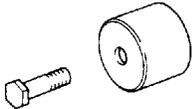
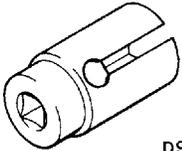
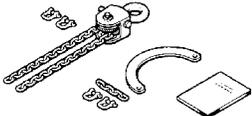
\*2: Indicates the value when more than 4 minutes have passed since the engine was started.

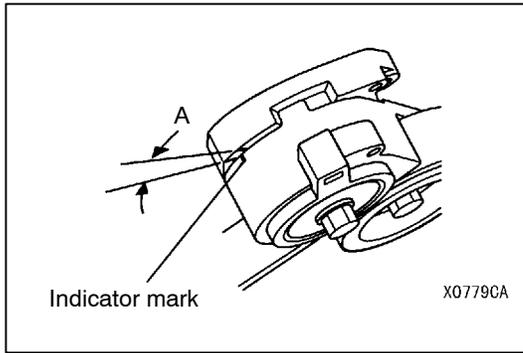
## SEALANT

Items	Specified sealants	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

## SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> <li>• Checking the ignition timing</li> <li>• Checking the idle speed</li> <li>• Erasing diagnosis code</li> </ul>
 B991800	MB991800	Pulley holder	Supporting of crankshaft pulley
 B991802	MB991802	Pin B	
	MD998769	Crankshaft pulley spacer	Operating the crankshaft when installing the timing belt
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	MD998718	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
	MD998781	Flywheel stopper	Securing the flywheel

Tool	Number	Name	Use
	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
	MB990767	End yoke holder	Supporting of camshaft sprocket
	MD998719	Crankshaft pulley holder pin	
	MD998761	Camshaft oil seal installer	Press-in of the camshaft oil seal
 <p>D998773</p>	MD998773	Detonation sensor wrench	Detonation sensor removal and installation
 <p>B991683</p>	MB991683	Sling chain set	Removal and installation of engine assembly



## ON-VEHICLE SERVICE

### DRIVE BELT TENSION CHECK AND ADJUSTMENT

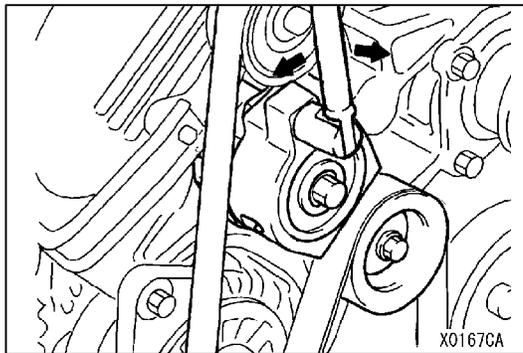
#### Caution

Perform the check after rotating the engine to the normal direction (one revolution and over).

1. Check that the indicator mark of the auto-tensioner is located within the scope shown as "A" on the tensioner bracket.
2. If the mark is located out of the scope "A," replace the drive belt.

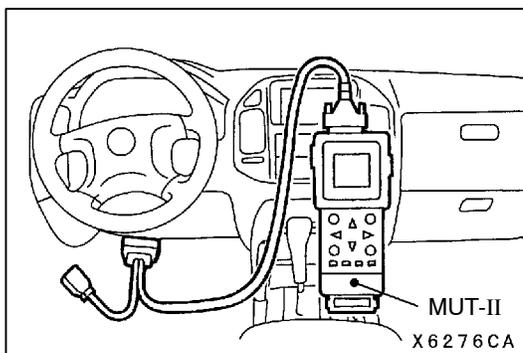
#### NOTE

Since the auto-tensioner is used, it is not necessary to adjust the tension of the belt.



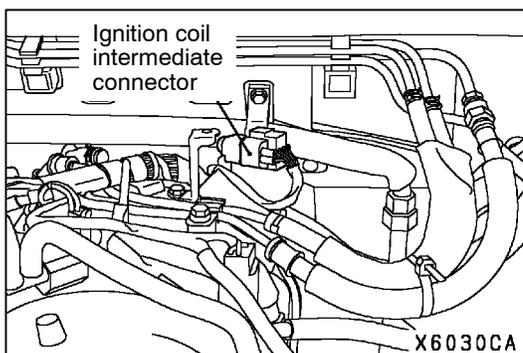
### AUTO-TENSIONER CHECK

1. Run the engine at idling speed and then stop it to check whether the drive belt is forced out from the width of the auto-tensioner pulley.
2. Remove the drive belt. (Refer P.11A-17.)
3. Move the auto-tensioner right and left by using a 12.7 mm spinner handle and the like to check whether there is no catch.
4. If some abnormality is found during the above mentioned check (1) and (3), replace the auto-tensioner.
5. Install the drive belt. (Refer P.11A-18.)



### IGNITION TIMING CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to the LOCK (OFF) position, and then connect the MUT-II to the diagnosis connector.



3. Set a timing light to the ignition coil power supply line (intermediate connector No. 7 terminal) of the ignition coil intermediate connector engine-side harness.
4. Start the engine and let it run at idle.
5. Use the MUT-II to measure engine idle speed and check that it is within the standard value.

**Standard value: 600 ± 100 (700 ± 100)\***

#### NOTE

\*: Indicates the values when more than 4 minutes have passed since the idling condition was started.

6. Select No.17 of the MUT-II Actuator test.  
NOTE  
At this time, the engine speed will become approximately 700 r/min.

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, inspect the GDI system while referring to GROUP 13A - Troubleshooting.
9. Press the MUT-II clear key (Select a forced driving cancel mode) to release the Actuator test.

**Caution**

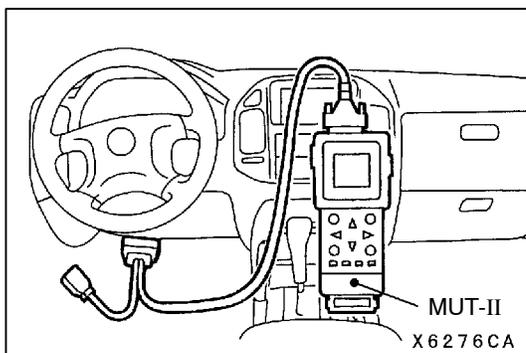
**If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.**

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

**Standard value: approx. 20° BTDC (AT)  
approx. 13° BTDC (MT)**

**NOTE**

- (1) The ignition timing will become approximately 5° BTDC after more than 4 minutes have passed since the basic ignition timing set mode was released.
  - (2) The ignition timing may fluctuate within ±7° BTDC. This is normal.
  - (3) In higher altitude, the ignition timing is more advanced than the standard value by approximately 5 degree.
11. Remove the timing light.
  12. Turn the ignition switch to the lock (OFF) position, and then disconnect the MUT-II.



**IDLE SPEED CHECK**

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to the lock (OFF) position, and then connect the MUT-II to the diagnosis connector.
3. Check the basic ignition timing.

**NOTE**

Refer to P.11A-6 concerning the check procedure of the basic ignition timing.

**Standard value: 5° BTDC ± 3°**

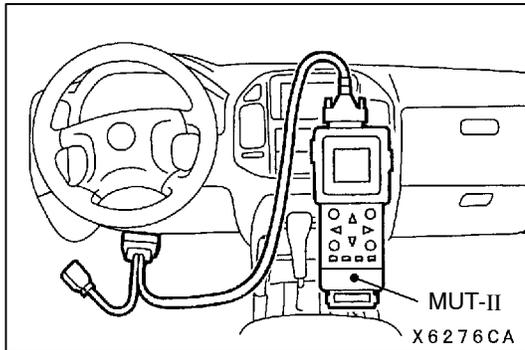
4. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

**Standard value: 600 ± 100 (700 ± 100)\***

**NOTE**

- (1) \*: Indicates the values when more than 4 minutes have passed since the idling condition was started.
- (2) The idle speed is controlled automatically by the idle speed control system.

5. If the idle speed is outside the standard value, inspect the GDI components by referring to GROUP 13A - Troubleshooting.



### IDLE MIXTURE CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to the lock (OFF) position, and then connect the MUT-II to the diagnosis connector.
3. Check that the basic ignition timing is within the standard value.

#### NOTE

Refer to P.11A-6 concerning the check procedure of the basic ignition timing.

**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.

#### NOTE

This measurement should be performed in less than approximately 4 minutes since the engine speed become the idle speed.

#### Standard value

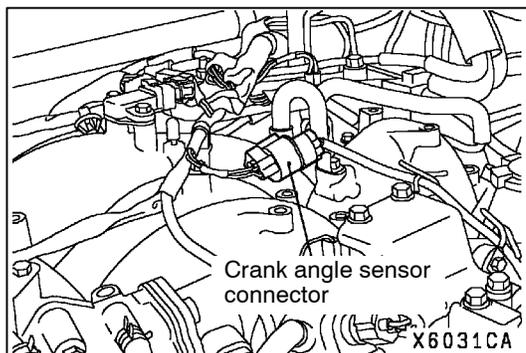
**CO contents: 0.5% or less**

**HC contents: 100 ppm or less**

7. If there is a deviation from the standard value, check the following items:
  - Diagnosis output
  - Fuel pressure
  - Injector
  - Ignition coil, spark plug
  - EGR control system
  - Evaporative emission control system
  - Compression pressure

#### NOTE

Replace the three way catalyst when the CO and HC contents are not within the standard value, even though the result of the inspection is normal on all items.



## COMPRESSION PRESSURE CHECK

1. Before inspection, check that the engine oil, starter and battery are normal. In addition, set the vehicle to the pre-inspection condition.
2. Remove all of the ignition coils and spark plugs.
3. Disconnect the crank angle sensor connector.

### NOTE

Doing this will prevent the engine-A/T-ECU from carrying out ignition and fuel injection.

4. 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.**
5. Set compression gauge to one of the spark plug holes.
  6. Crank the engine with the throttle valve fully open and measure the compression pressure.

**Standard value (at engine speed of 280 r/min):**  
**1,275 kPa**

**Limit (at engine speed of 280 r/min):**  
**Min. 980 kPa**

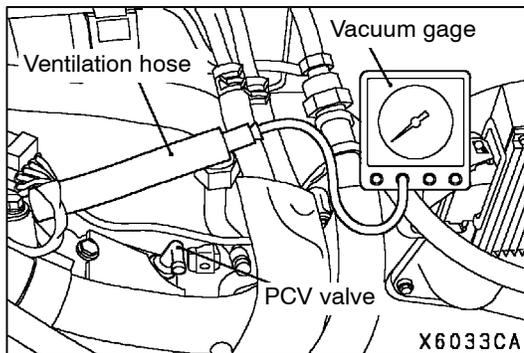
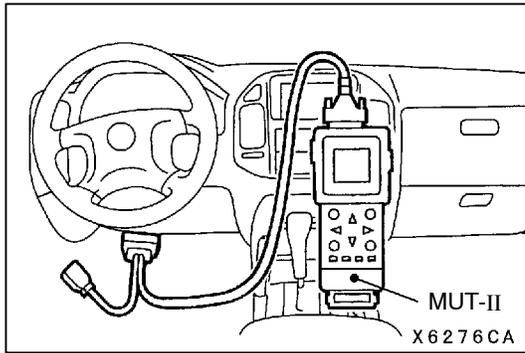
7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

**Limit: Max. 98 kPa**

8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps 6 and 7.
  - (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
  - (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the crank angle sensor connector.
10. Install the spark plugs and ignition coils.
11. Use the MUT-II to erase the diagnosis codes.

### NOTE

This will erase the diagnosis code resulting from the crank angle sensor connector being disconnected.



## INTAKE MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to the LOCK (OFF) position.
3. Connect the diagnosis connector to the MUT-II.
4. Remove the ventilation hose from the PCV valve, connect the ventilation hose to a vacuum gauge, and then plug the PCV valve.
5. Start the engine, and let it run at idle.
6. Keep the engine run at idle for at least 4 minutes. The idle speed should be 700 r/min.
7. Check the intake manifold vacuum.

### Limit: Min. 60 kPa

8. Turn the ignition switch to the LOCK (OFF) position.
9. Remove the vacuum gauge, and return the ventilation hose to its normal condition.
10. Remove the MUT-II.

## LASH ADJUSTER CHECK

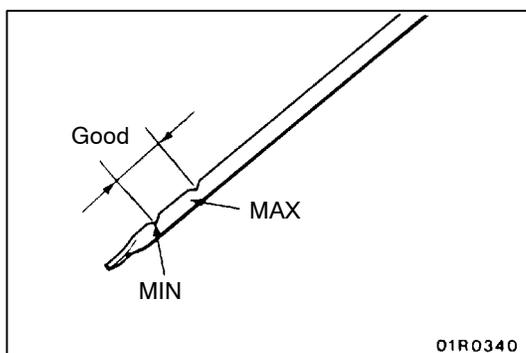
If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

### NOTE

- (1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
- (2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes time for the oil to be supplied to the lash adjuster, so air can get into the high pressure chamber.
- (3) If either of the above situations occur, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.
- (4) The abnormal noise, which is caused by a defective lash adjuster, occurs immediately after the engine start and changes in accordance with the engine speed, but not the engine load.
- (5) If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.  
The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

**FUNCTIONAL TEST**

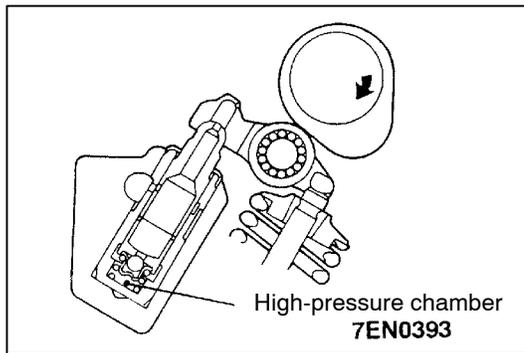
1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.  
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N → D).  
If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings. (In such cases, the lash adjusters are normal.)
4. After the engine has warmed up, run it at idle and check if any noise can be heard.  
If the noise has become smaller or disappeared, oil sludge could make the lash adjusters stick. Clean the lash adjusters. (Refer to the Engine Workshop Manual.) If not improved, go to step 5.
5. Bleed air from the lash adjusters. (Refer to P.11A-11.)
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters. (Refer to the Engine Workshop Manual.)

**LASH ADJUSTER AIR BLEEDING**

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

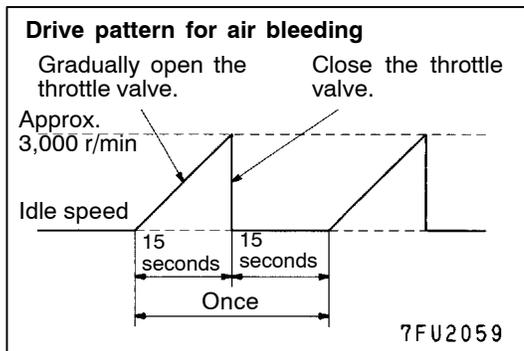
**NOTE**

- (1) If there is a only small amount of oil, air will be drawn in through the oil screen and will get into the oil passage.
- (2) If the amount of oil is greater than normal, then the oil will being mixed by the crankshaft and a large amount of air may get mixed into the oil.
- (3) If the oil is degenerated, air and oil will not separate easily in oil, and the amount of air mixed into the oil will increase.



If the air which has been mixed in with the oil due to any of the above reasons gets into the high pressure chamber of the lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the lash adjuster will over-compress, resulting in abnormal noise when the valve closes.

This is the same effect as if the valve clearance is adjusted to be too large by mistake. If the air inside the lash adjusters is then released, the operation of the lash adjusters will return to normal.



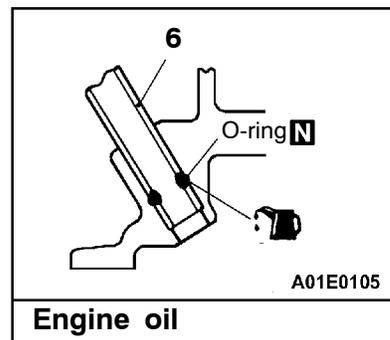
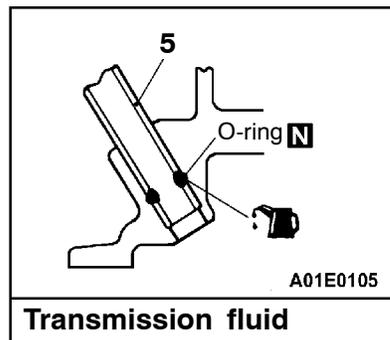
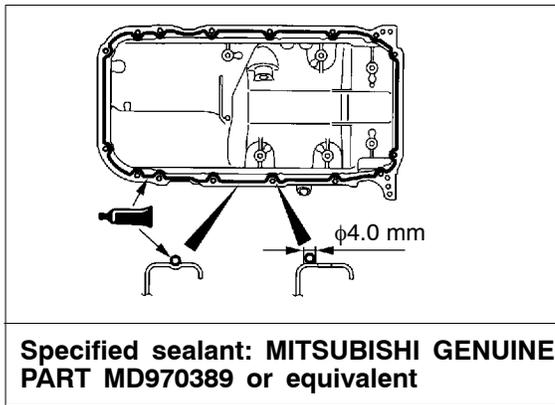
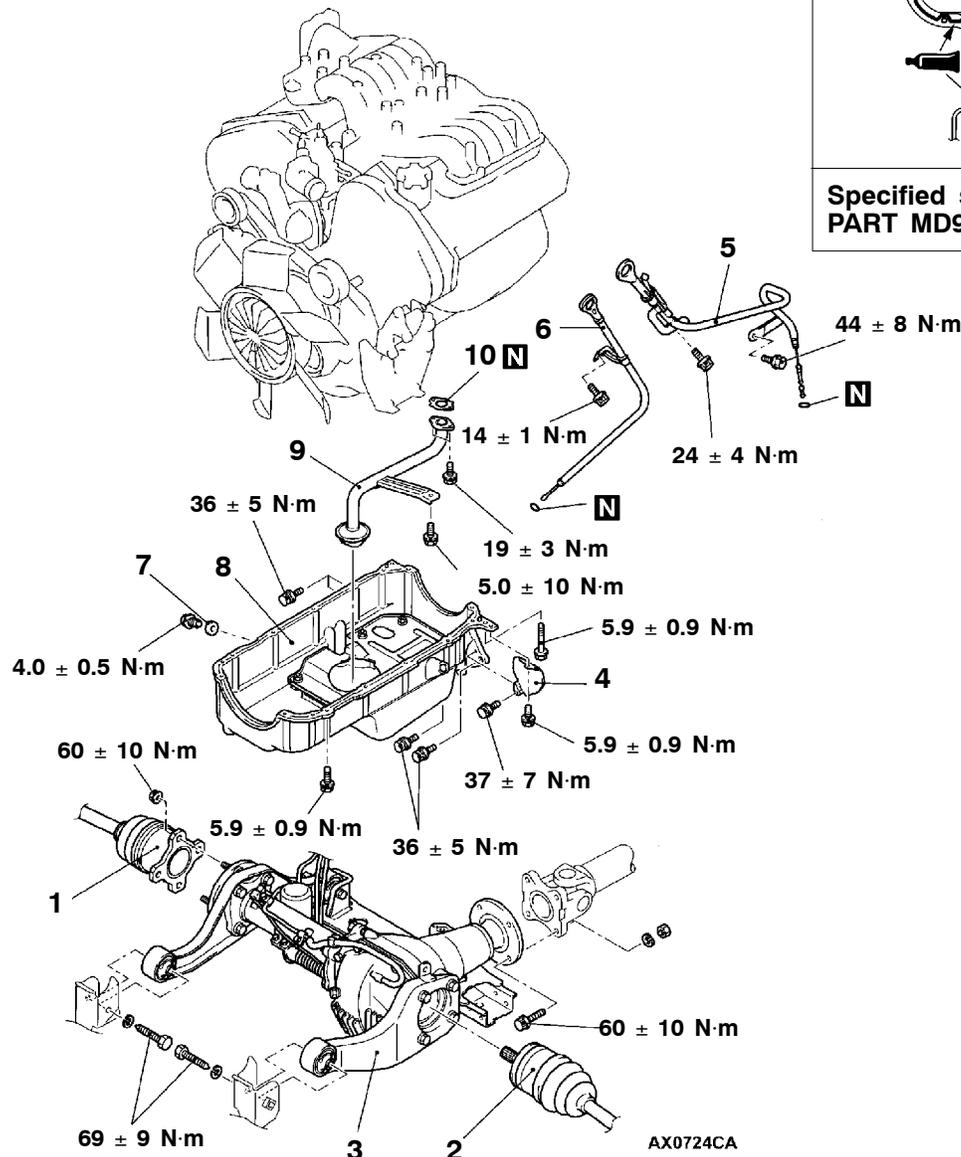
2. Run the engine at idle for 1 - 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 - 30 repetitions, but if there is no change in the noise level after 30 repetitions or more, the problem is probably not due to air inside the lash adjusters.)
4. After the noise has disappeared, repeat the drive pattern shown in the illustration at left a further 5 times.
5. Run the engine at idle for 1 - 3 minutes and check that the noise has disappeared.

# OIL PAN AND OIL SCREEN

## REMOVAL AND INSTALLATION

### Pre-removal and Post-installation Operation

- Skid Plate and Under Cover Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Starter Assembly Removal and Installation (Refer to GROUP 16 - Starting System.)

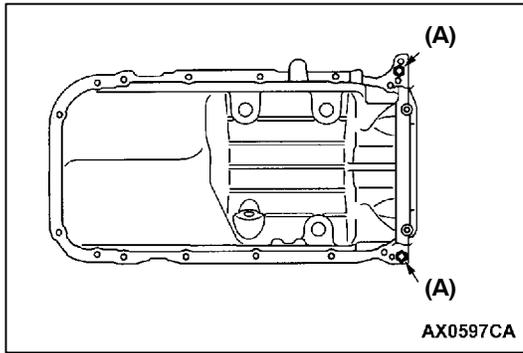


### Removal steps

1. Drive shaft <R.H.>
2. Drive shaft <L.H.>
3. Front differential, No.2 crossmember
4. Cover
5. A/T oil dipstick assembly



6. Engine dipstick assembly
7. Gasket
8. Oil pan
9. Oil screen
10. Gasket



## REMOVAL SERVICE POINT

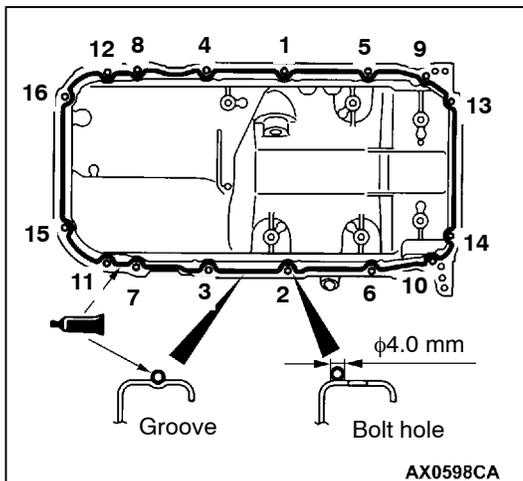
### ◀A▶ OIL PAN REMOVAL

1. Remove the oil pan installation bolts.

#### Caution

The use of an oil pan remover (MD998727) can damage the oil pan (aluminum made).

2. Screw the bolts (M10) securing the oil pan to the transmission assembly in the illustrated bolt holes, then remove the oil pan.



## INSTALLATION SERVICE POINTS

### ▶A◀ OIL PAN INSTALLATION

1. Remove sealant from the oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine mating surface.
3. Apply MITSUBISHI genuine part number MD970389 or equivalent around the gasket surface of oil pan as specified in the illustration.

#### NOTE

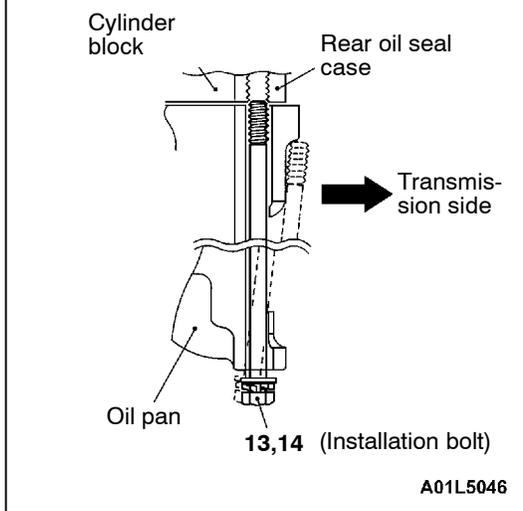
The sealant should be applied in a continuous bead approximately 4.0 mm in diameter.

4. Assemble the oil pan to the cylinder block within 30 minutes after applying the sealant.

#### Caution

The bolt holes for bolts 13 and 14 in the illustration are cut away on the transmission side. Be careful not to insert these bolts at an angle.

5. Tighten the bolts in order of the numbers shown in the illustration.

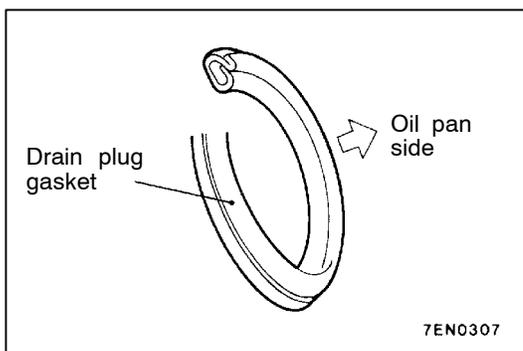


### ▶B◀ DRAIN PLUG GASKET INSTALLATION

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

## INSPECTION

- Check the oil pan for cracks.
- Check the oil pan sealant-coated surface for damage and deformation.
- Check the oil screen for cracked, clogged or damaged wire net and pipe.

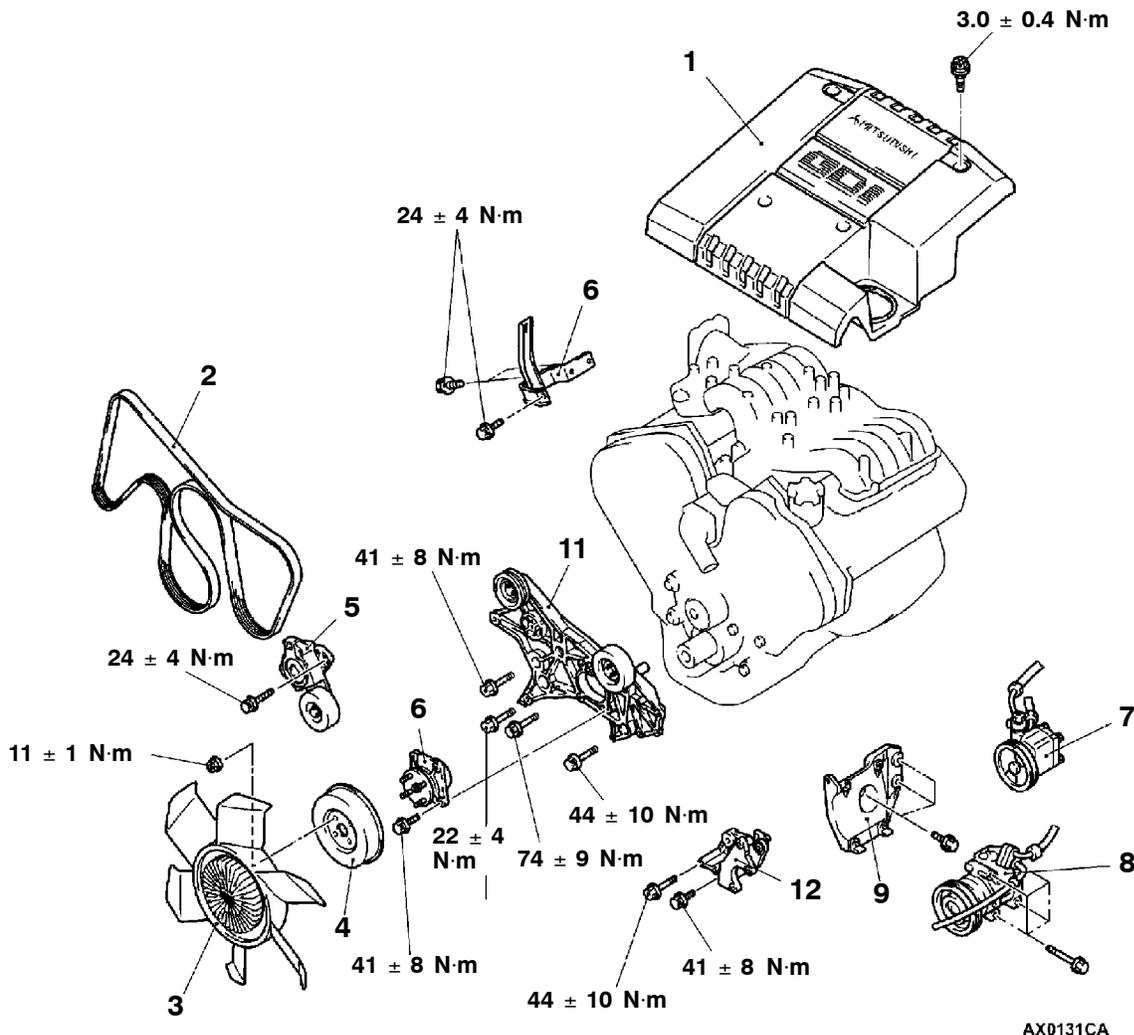


# TIMING BELT

## REMOVAL AND INSTALLATION

### Pre-removal Operation

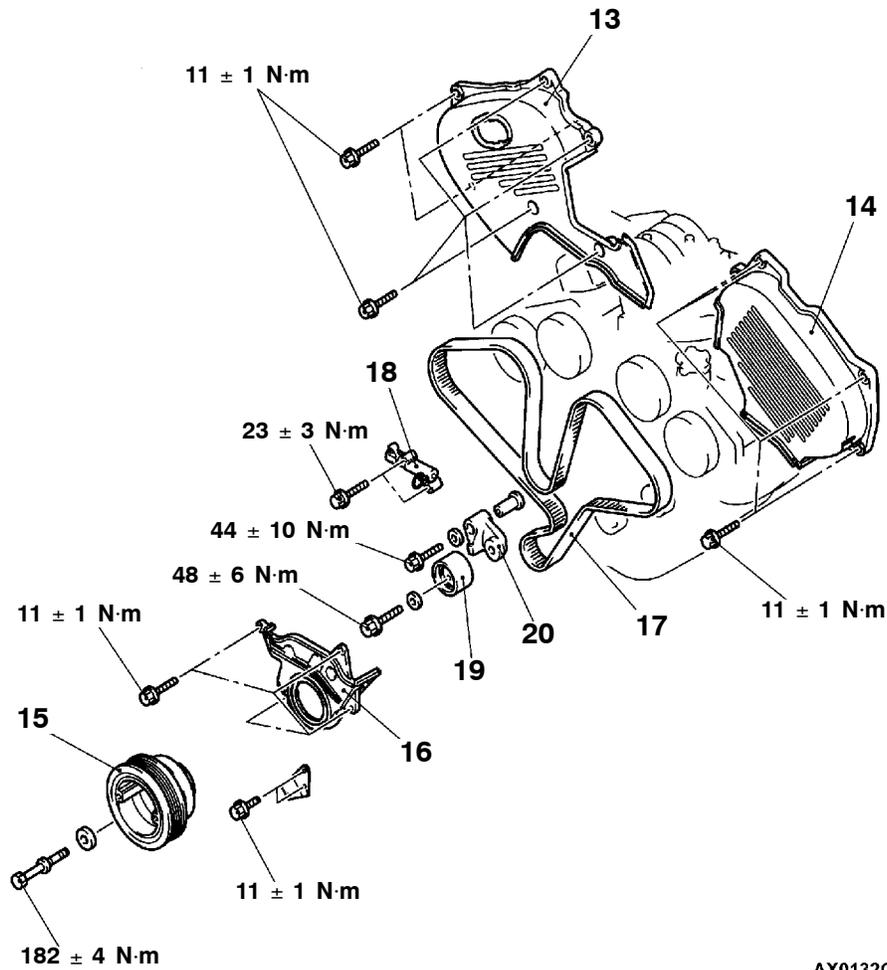
- Skid Plate and Under Cover Removal and Installation
- Battery and battery tray Removal and Installation
- Air cleaner assembly Removal and Installation (Refer to GROUP 15)
- Shroud assembly Removal and Installation (Refer to GROUP 14 - Cooling Fan.)
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)



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### Removal steps

- |                           |   |                       |   |
|---------------------------|---|-----------------------|---|
| <p>▶F◀</p> <p>◀A▶ ▶E▶</p> | <p>1. Cover</p> <p>2. Drive belt</p> <p>3. Cooling fan and fan clutch assembly</p> <p>4. Cooling fan pulley</p> <p>5. Drive belt auto-tensioner</p> <p>6. Engine hanger &lt;R.H.&gt;</p> <ul style="list-style-type: none"> <li>• Alternator (Refer to Group16.)</li> </ul> | <p>◀B▶</p> <p>▶D▶</p> | <p>7. Power steering oil pump assembly</p> <p>8. A/C compressor assembly</p> <p>9. Compressor bracket</p> <p>10. Cooling fan bracket</p> <p>11. Accessory mount assembly</p> <p>12. Power steering oil pump bracket</p> |
|---------------------------|---|-----------------------|---|



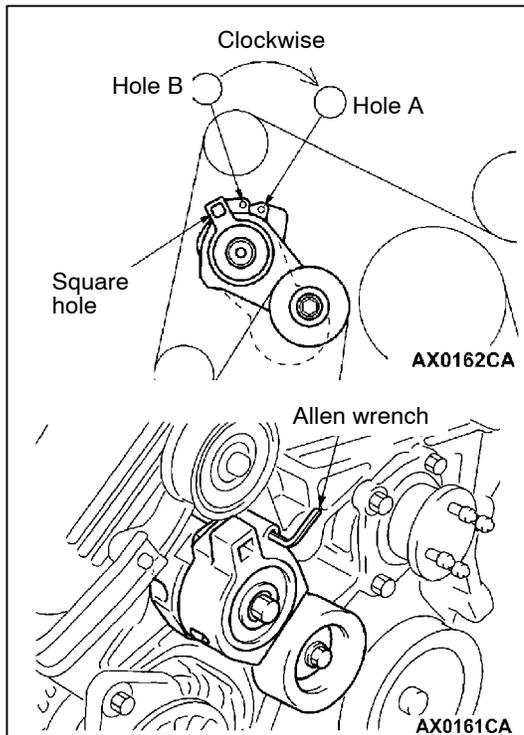
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**Removal steps**

- 13. Timing belt upper cover assembly <R.H.>
- 14. Timing belt upper cover assembly <L.H.>
- 15. Crankshaft pulley



- 16. Timing belt lower cover assembly
- 17. Timing belt
- 18. Auto-tensioner
- 19. Tension pulley
- 20. Tensioner arm assembly



## REMOVAL SERVICE POINTS

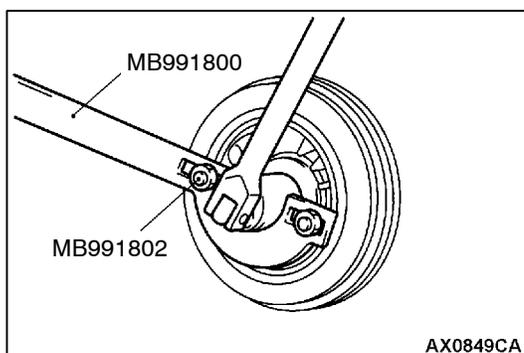
### ◀A▶ DRIVE BELT AUTO-TENSIONER REMOVAL

The following operations will be needed due to the introduction of the serpentine drive system with the drive belt auto tensioner.

1. Insert a 12.7 mm spinner handle into the square hole on the drive belt auto tensioner, and rotate it clockwise until the tensioner touches the stopper.
2. Align hole B with hole A, and insert a 5.0 mm Allen wrench to hold the tensioner. Then loosen the drive belt, and then remove the drive belt auto tensioner.

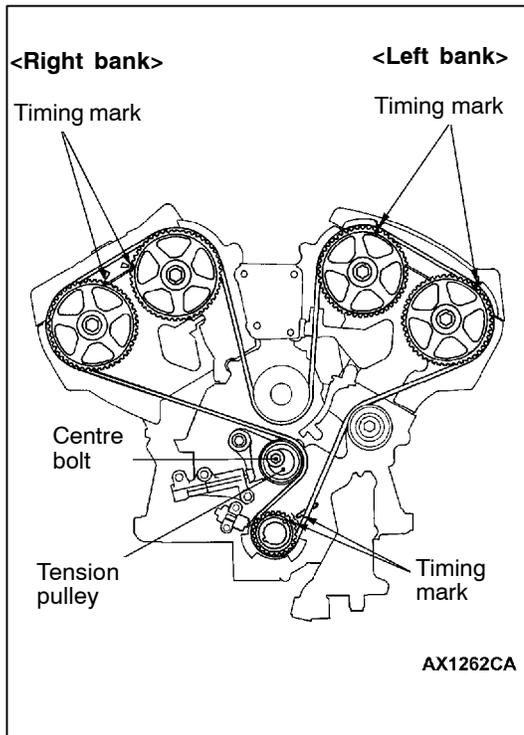
### ◀B▶ POWER STEERING OIL PUMP ASSEMBLY/A/C COMPRESSOR ASSEMBLY REMOVAL

1. Do not disconnect the hoses to remove the pump and compressor.
2. Support the removed pump and compressor with a wire, etc. so that they will not get in the way while working.



### ◀C▶ CRANKSHAFT PULLEY REMOVAL

Use special tools to remove the crankshaft pulley from the crankshaft.

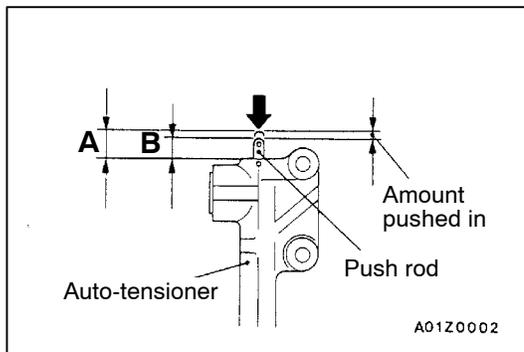


### ◀D▶ TIMING BELT REMOVAL

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

#### Caution

- (1) **The camshaft sprocket (right side) can turn easily due to the valve spring force applied, so be careful not to get your fingers caught.**
  - (2) **Never turn the crankshaft anticlockwise.**
2. If the timing belt is to be reused, chalk mark the flat side of the belt with an arrow indicating the clockwise direction.
  3. Loosen the centre bolt of the tension pulley, and then remove the timing belt.



### INSTALLATION SERVICE POINTS

#### ▶A◀ AUTO-TENSIONER INSTALLATION

1. While holding the auto-tensioner by hand, press the end of the push rod against a metal surface (such as the cylinder block) with a force of 98 - 196 Nm and measure how far the push rod is pushed in.

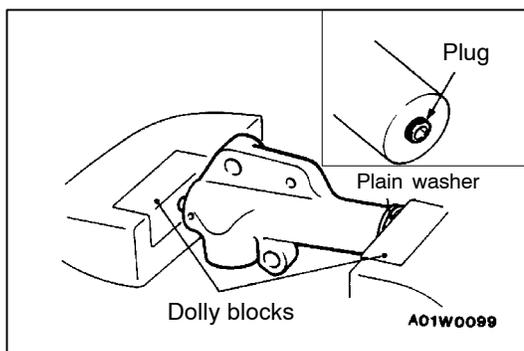
**Standard value: Within 1 mm**

**A: Length when no force is applied**

**B: Length when force is applied**

**A - B: Amount pushed in**

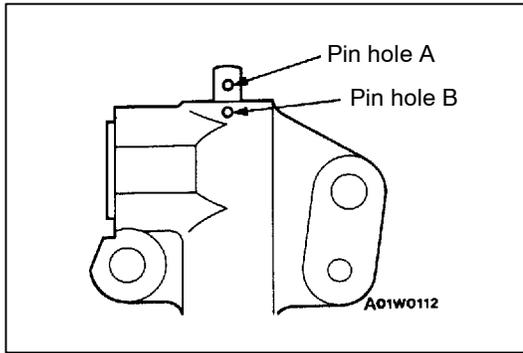
2. If it is not within the standard value, replace the auto-tensioner.



3. Place two dolly blocks in a vice as shown in the illustration, and then place the auto-tensioner in the vice.

#### Caution

- (1) **Place the auto-tensioner perpendicular to the jaws of the vice.**
- (2) **If there is a plug at the base of the auto-tensioner, insert a plain washer onto the end of the auto-tensioner to protect the plug.**



- Slowly compress the push rod of the auto-tensioner until pin hole A in the push rod is aligned with pin hole B in the cylinder.

**Caution**

**Never compress the push rod too fast, or the push rod may be damaged.**

- Insert the setting pin into the pin holes once they are aligned.

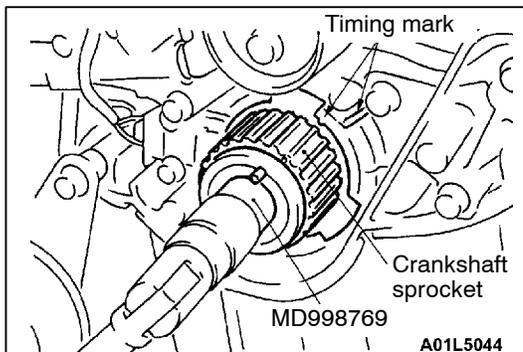
**NOTE**

If replacing the auto-tensioner, the pin will already be inserted into the pin holes of the new part.

- Install the auto-tensioner to the engine.

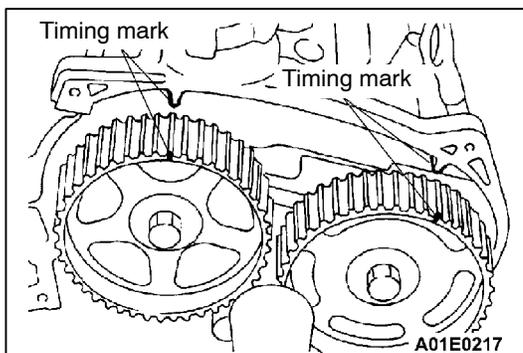
**Caution**

**Do not remove the setting pin from the auto-tensioner.**

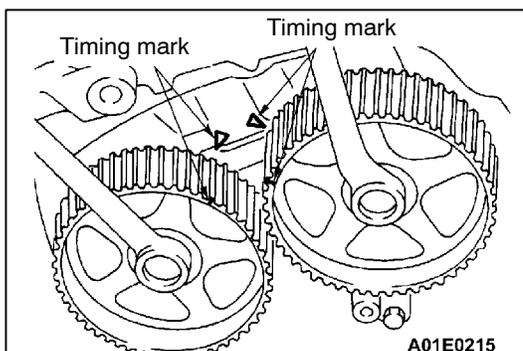


**►B◄ TIMING BELT INSTALLATION**

- Use special tool to align the timing marks on the crankshaft sprocket.



- Align the timing marks on the right bank side crankshaft sprocket.

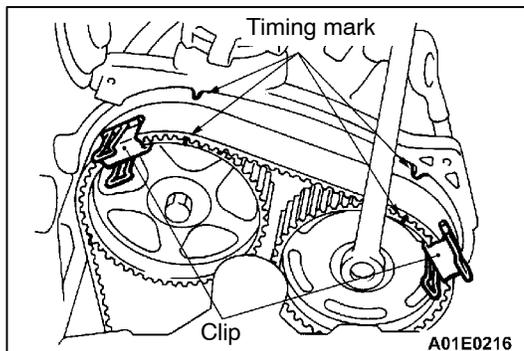


- Align the timing marks on the left bank side crankshaft sprocket, and then hold the sprocket with a wrench as shown.

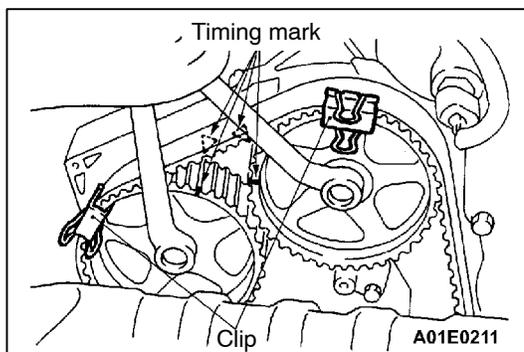
**Caution**

**(1) The left bank side camshaft sprockets will turn readily because of the spring force being applied, so be careful not to get your fingers caught.**

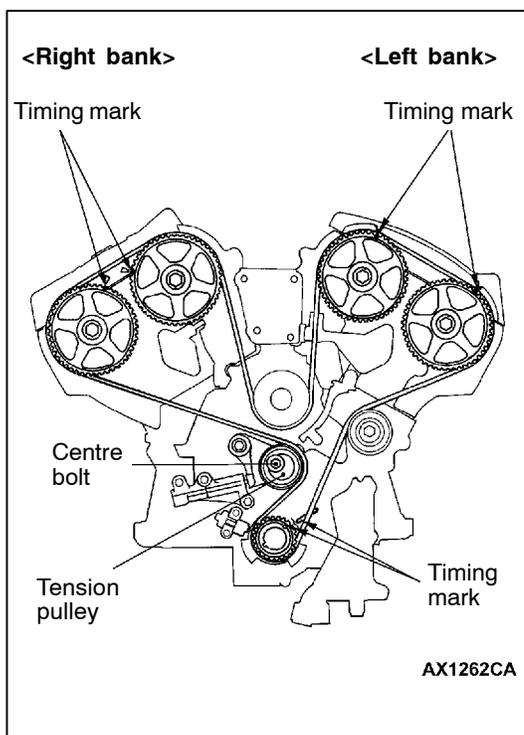
- (2) If the sprocket on one side of the left bank is turned one full revolution while the sprocket timing marks on the opposite side of the left bank are aligned, the intake and exhaust valves will interfere.



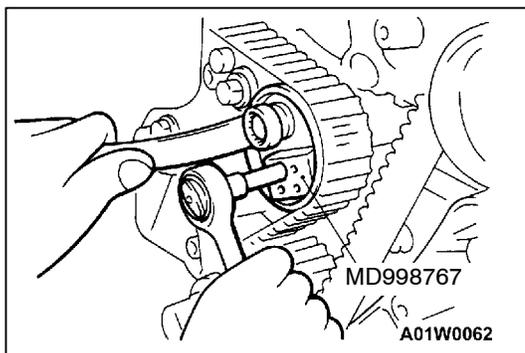
4. Set the timing belt onto the crankshaft sprocket.
5. Set the timing belt onto the idler pulley.
6. Check that the timing marks of the left bank side exhaust camshaft sprocket is aligned, and clamp the timing belt with a clip.
7. Set the timing belt onto the water pump pulley.



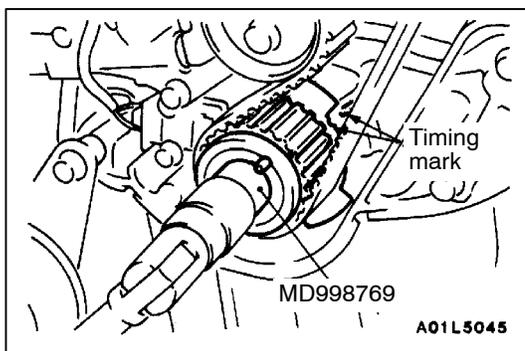
8. Check that the timing marks of the right bank side exhaust camshaft sprocket is aligned, and clamp the timing belt with a clip.
9. Set the timing belt onto the tension pulley.



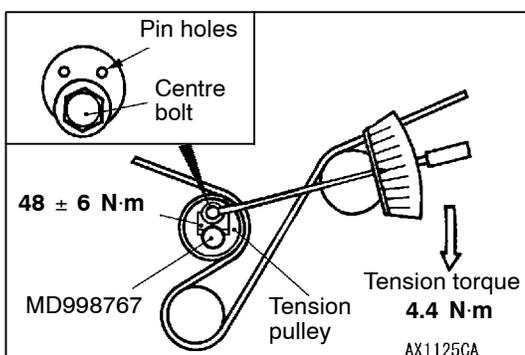
10. Turn the right bank side camshaft sprocket (exhaust side) anticlockwise until the tension side of the timing belt is firmly stretched. Check all timing marks again.



11. Use special tool to push the tensioner pulley into the timing belt, and then temporarily tighten the centre bolt.
12. Loosen all the clips.



13. Use special tool to turn the crankshaft 1/4 turn anticlockwise and then turn it again clockwise until the timing marks are aligned.

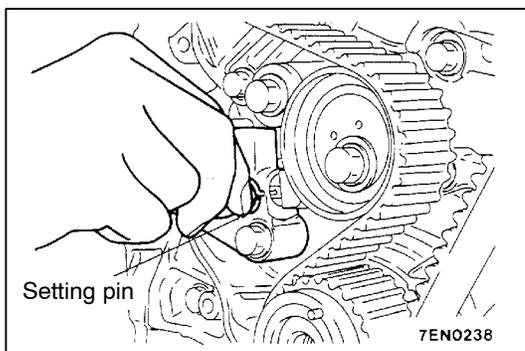


14. Loosen the centre bolt of the tensioner pulley. Use special tool and a torque wrench to apply the standard torque to the timing belt as shown in the illustration. Then tighten the centre bolt to the specified torque.

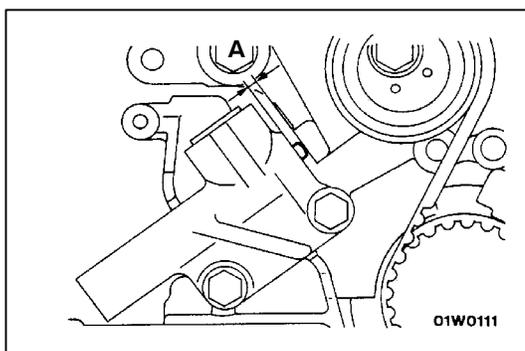
**Standard value: 4.4 N·m**  
**<Timing belt tension torque>**

**Caution**

**When tightening the centre bolt, be careful that the tensioner pulley does not turn with the bolt.**



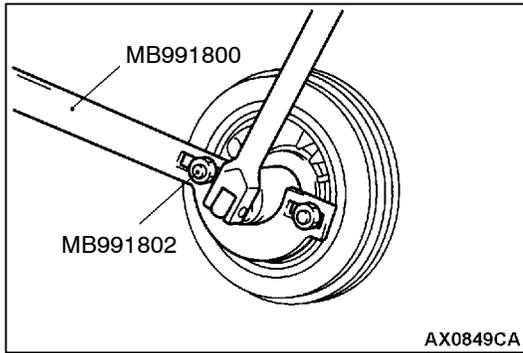
15. Remove the setting pin that has been inserted into the auto-tensioner.
16. Turn the crankshaft two turns clockwise to align the timing marks.



17. Wait for at least five minutes, and then check that the auto-tensioner pushrod extends within the standard value.

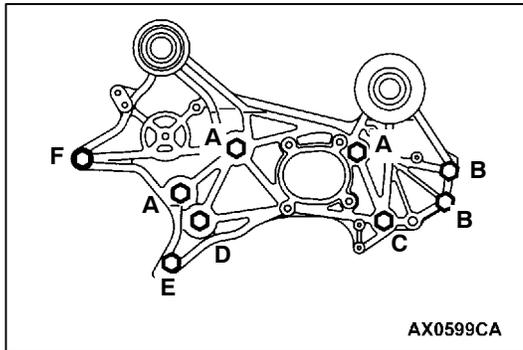
**Standard value (A): 3.8 - 5.0 mm**

18. If no, repeat the operation in steps (13) to (17) above.
19. Check again that the timing marks of each sprocket are aligned.



### ►C◄ CRANKSHAFT PULLEY INSTALLATION

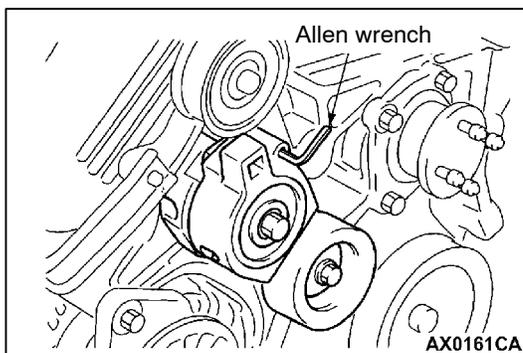
Use special tools MD991800 and MB991802 to install the crankshaft pulley.



### ►D◄ ACCESSORY MOUNT ASSEMBLY INSTALLATION

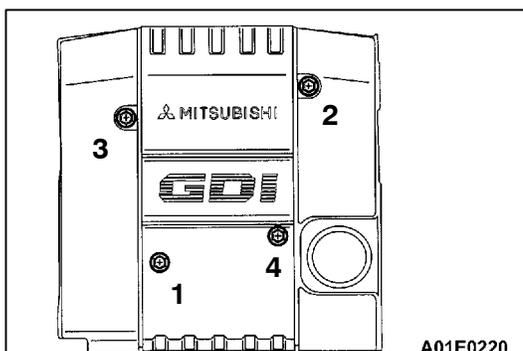
Install the bolts to the shown positions, and tighten them to the specified torque.

Bolt (symbol)	Diameter x length mm	Tightening torque(N·m)
A	10x100	41 ± 8
B	10x30	41 ± 8
C	10x100	44 ± 10
D	12x100	74 ± 9
E	8x30	22 ± 4
F	10x106	44 ± 10



### ►E◄ DRIVE BELT AUTO TENSIONER INSTALLATION

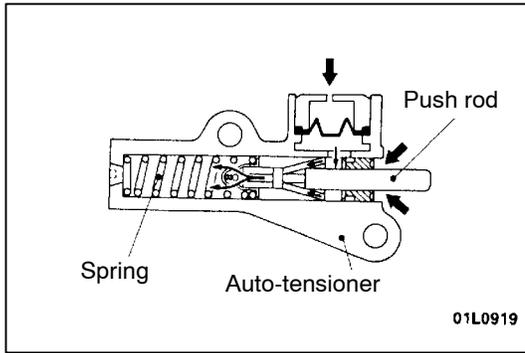
1. Install the drive belt auto tensioner with the Allen wrench inserted.
2. After the drive belt has been installed, remove the Allen wrench while holding the drive belt auto tensioner with a socket wrench drive. Then release the drive belt auto tensioner slowly.



### ►F◄ ENGINE COVER INSTALLATION

Install the engine cover bolts finger-tight, and tighten them to the specified torque in the order shown.

**Tightening torque: 3.0 ± 0.4 N·m**



## INSPECTION

### AUTO-TENSIONER

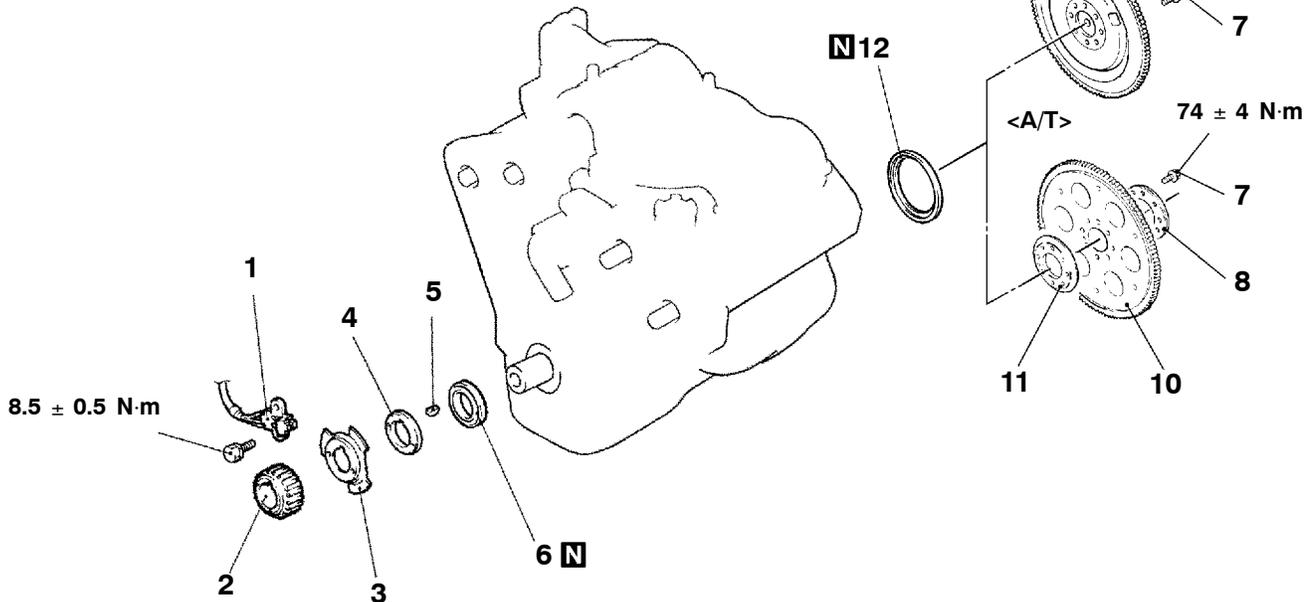
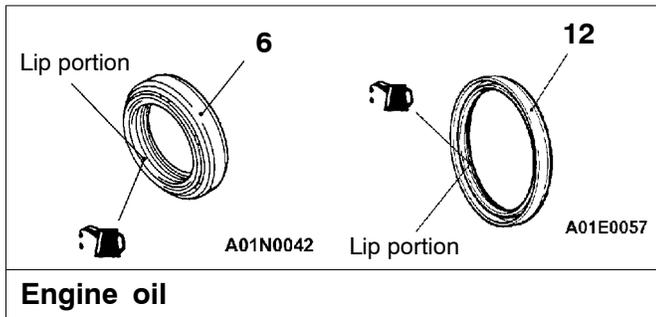
- Check the auto-tensioner for possible leaks.
- Check the push rod for cracks.

## CRANKSHAFT OIL SEAL

### REMOVAL AND INSTALLATION

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

- Timing Belt Removal and Installation (Refer to P.11A-15.)

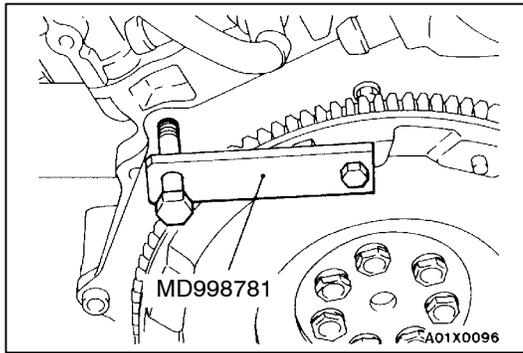


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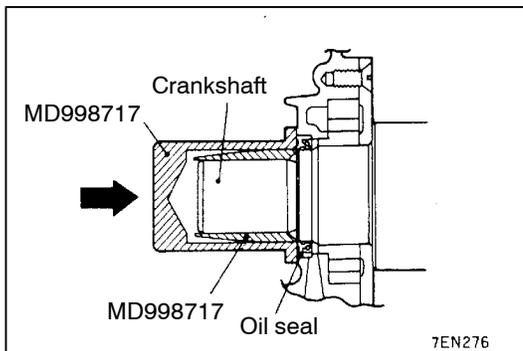
#### Removal steps

- ◀D▶ 1. Crank angle sensor
- ◀D▶ 2. Crankshaft sprocket
- ◀D▶ 3. Crankshaft sensing blade
- ◀D▶ 4. Crankshaft spacer
- ▶C▶ 5. Key
- ▶C▶ 6. Crankshaft front oil seal

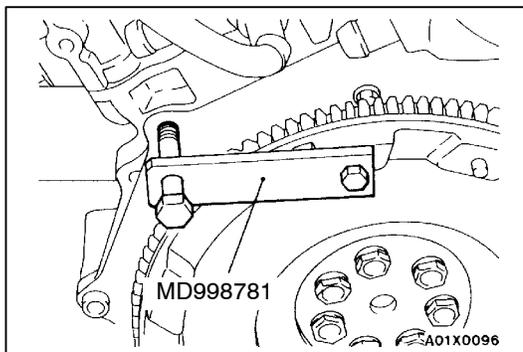
- ◀A▶ ▶B▶ 7. Bolt
- 8. Adaptor plate
- 9. Flywheel
- 10. Drive plate
- 11. Crankshaft adaptor
- ▶A▶ 12. Crankshaft rear oil seal

**REMOVAL SERVICE POINT****◀A▶ BOLT REMOVAL**

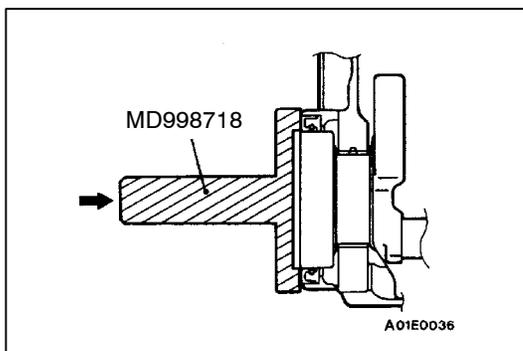
Use special tool to secure the flywheel or drive plate and remove the bolt.

**INSTALLATION SERVICE POINTS****▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION**

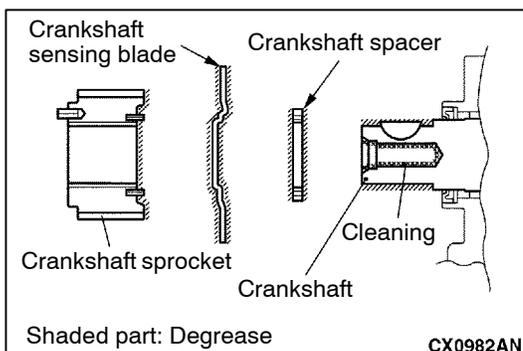
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Use special tool to tap in the oil seal as shown in the illustration.

**▶B◀ BOLT INSTALLATION**

Use special tool in the same way as during removal to install the bolt.

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

1. Apply a small amount of engine oil to the oil seal lip and then insert.
2. Using special tool, tap the oil seal into the front case.

**▶D◀ CRANKSHAFT SPACER/CRANKSHAFT SENSING BLADE/CRANKSHAFT SPROCKET**

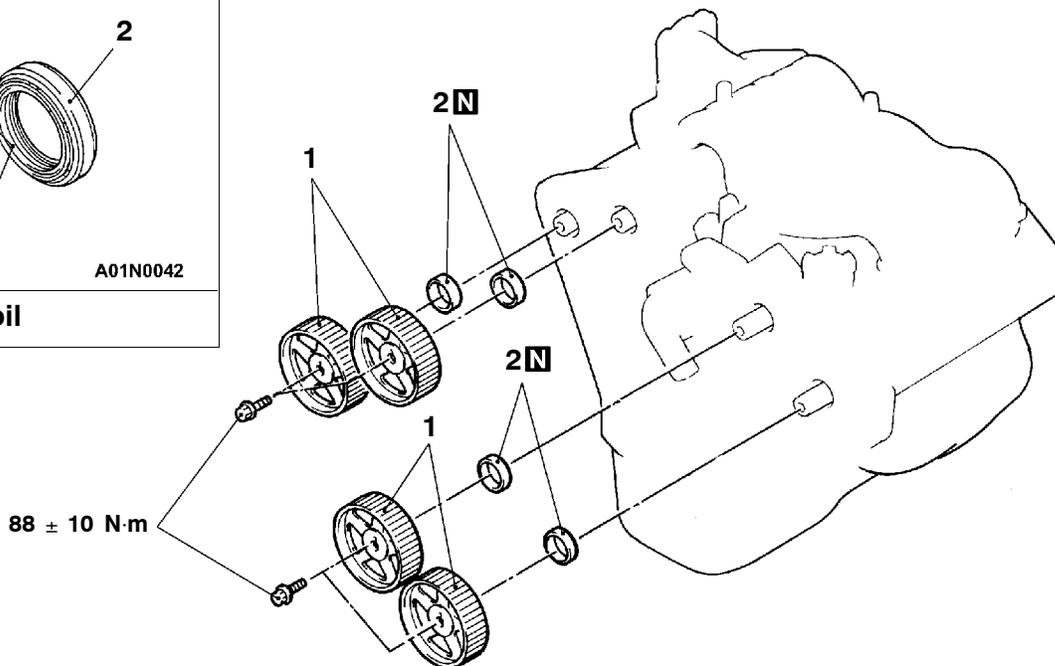
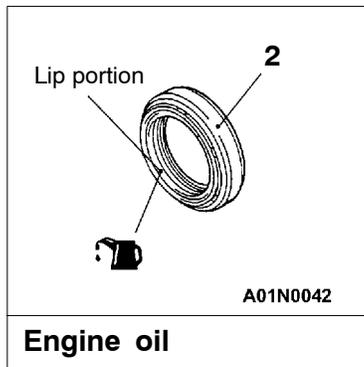
To prevent the crankshaft pulley mounting bolt from loosening, degrease or clean the crankshaft, the crankshaft spacer, the crankshaft sensing blade and the crankshaft at the shown positions.

# CAMSHAFT OIL SEAL

## REMOVAL AND INSTALLATION

### Pre-removal and Post-installation Operation

- Timing Belt Removal and Installation (Refer to P.11A-15.)

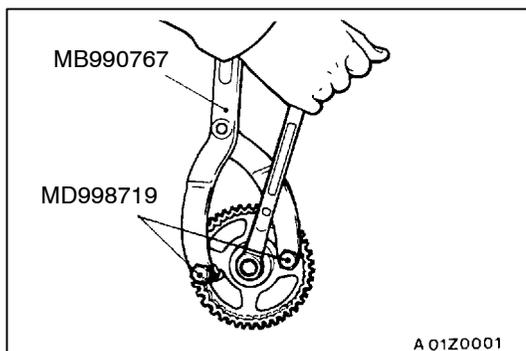


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### Removal steps



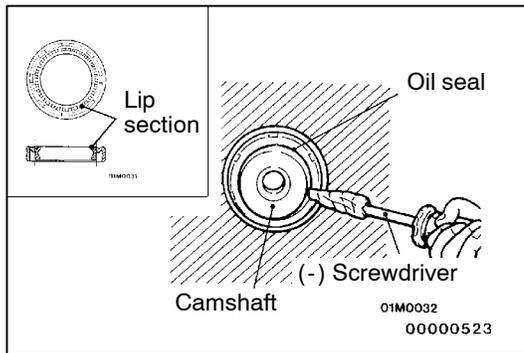
1. Camshaft sprocket
2. Camshaft oil seal



### REMOVAL SERVICE POINTS

#### ◀A▶ CAMSHAFT SPROCKET REMOVAL

Use special tools to remove the camshaft sprocket.



### ◀B▶ CAMSHAFT OIL SEAL REMOVAL

1. Make a notch in the oil seal lip section with a knife, etc.
2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the oil seal, and pry out the oil seal to remove it.

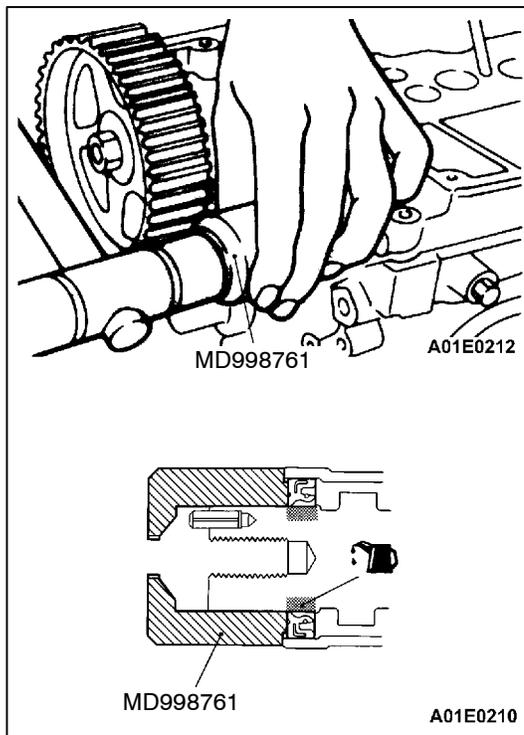
#### Caution

Be careful not to damage the camshaft and the cylinder head.

### INSTALLATION SERVICE POINTS

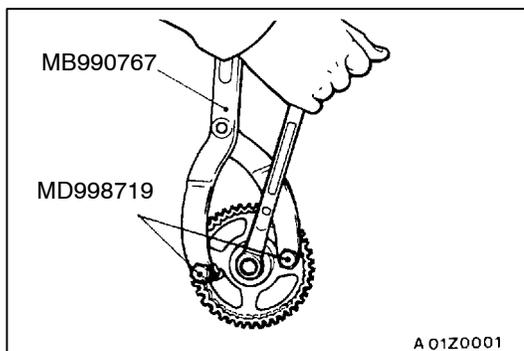
#### ▶A◀ CAMSHAFT OIL SEAL INSTALLATION

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



#### ▶B◀ CAMSHAFT SPROCKET INSTALLATION

Use special tools in the same way as during removal to install the camshaft sprocket.

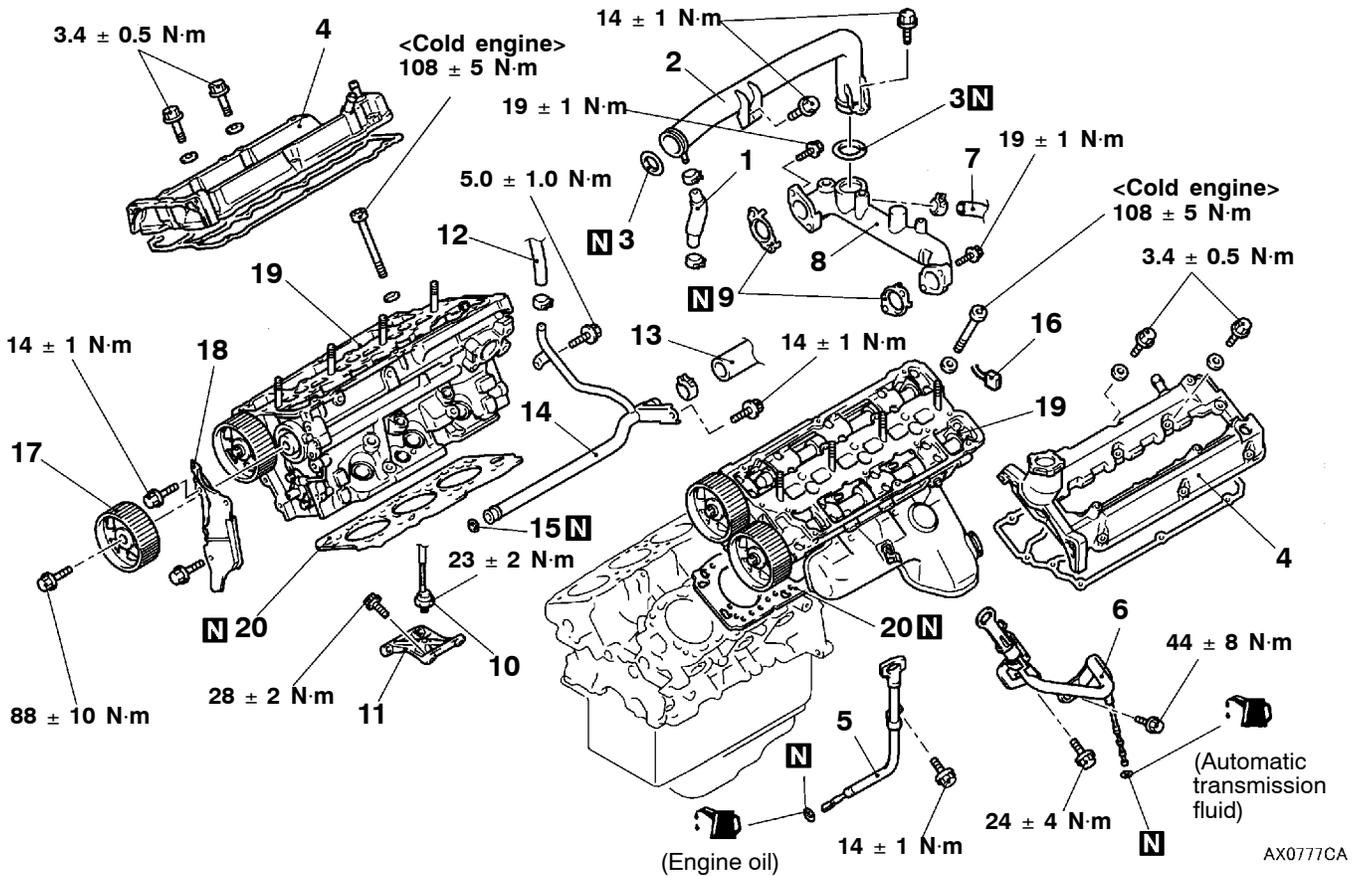


# CYLINDER HEAD GASKET

## REMOVAL AND INSTALLATION

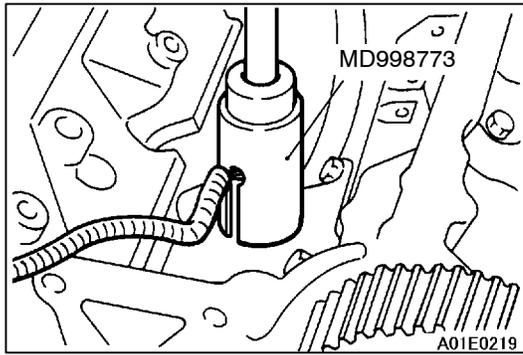
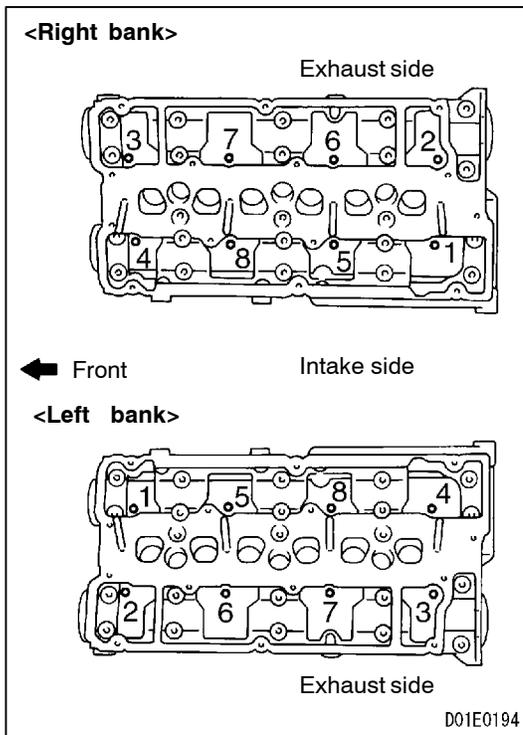
### Pre-removal and Post-installation Operation

- Fuel Discharge Prevention (Pre-removal operation)
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15 - Exhaust Pipe and Main Muffler.)
- Timing Belt Removal and installation (Refer to P.11A-15.)
- Thermostat Case and Water Inlet Fitting Removal and Installation (Refer to GROUP 14 - Water Pump.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 - Intake Manifold.)
- Fuel Pump (High Pressure) Removal and Installation (Refer to GROUP 13.)

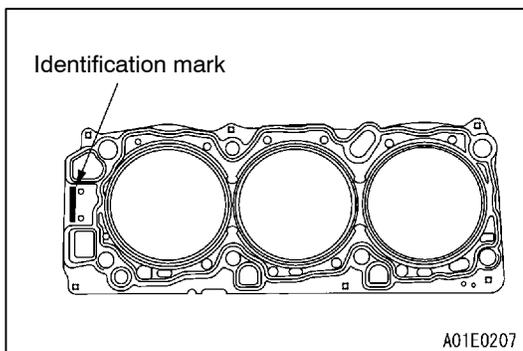


### Removal steps

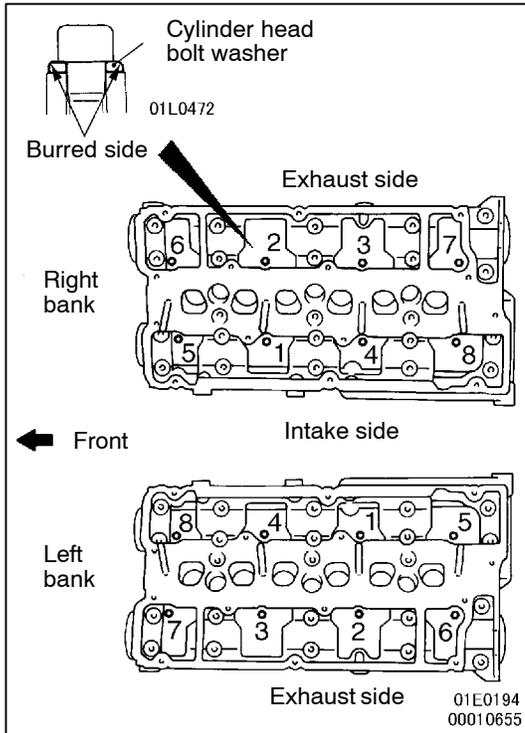
- |     |   |   |
|-----|---|---|
|     | 1. Water hose   | 12. Water hose connection   |
|     | 2. Water outlet pipe assembly                                 | 13. Heater hose connection  |
| ▶C◀ | 3. O-ring   | 14. Water pipe assembly   |
|     | 4. Rocker cover   | ▶C◀ 15. O-ring  |
|     | 5. Oil dipstick assembly <when removing left bank only>       | 16. Camshaft position sensor connector <when removing left bank only> |
|     | 6. A/T Fluid dipstick assembly <when removing left bank only> | 17. Camshaft sprocket (Intake side) <when removing right bank only>   |
|     | 7. Heater hose connection                                     | 18. Timing belt rear cover <when removing right bank only>            |
| ▶E◀ | 8. Water passage assembly                                     | ▶B◀ ▶A◀ 19. Cylinder head assembly                                    |
| ▶E◀ | 9. Gasket   | ▶A◀ 20. Cylinder head gasket  |
| ▶D◀ | 10. Detonation sensor   |   |
| ▶A◀ | 11. Detonation sensor bracket                                 |   |

**REMOVAL SERVICE POINTS****◀A▶ DETONATION SENSOR REMOVAL****◀B▶ CYLINDER HEAD ASSEMBLY REMOVAL**

Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head bolt.

**IINSTALLATION SERVICE POINTS****▶A◀ CYLINDER HEAD GASKET INSTALLATION**

1. Degrease the cylinder head and cylinder block gasket mounting surfaces.
2. Make sure that the gasket has the proper identification mark for the engine.
3. Lay the cylinder head gasket on the cylinder block with the identification mark at the front top.

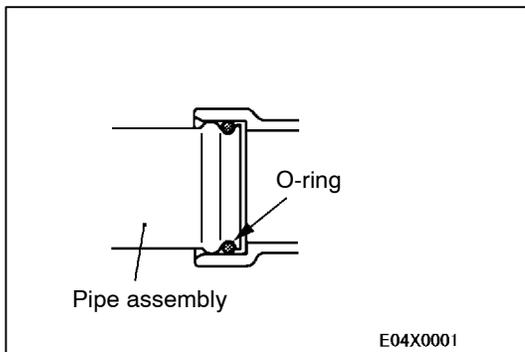


**►B◄ CYLINDER HEAD ASSEMBLY INSTALLATION**

Tighten the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and install the cylinder head bolt.

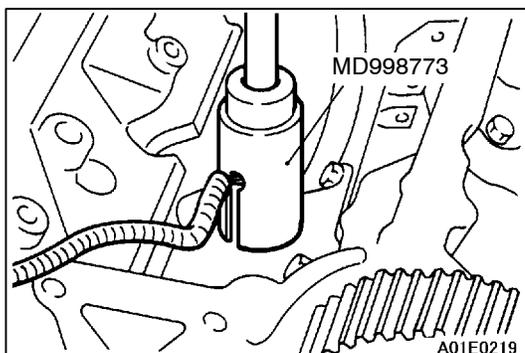
**Caution**

Install the head bolt washers with the beveled side facing upwards as shown in the illustration.

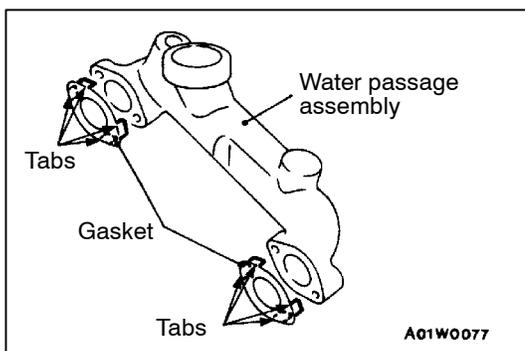


**►C◄ O-RING INSTALLATION**

Insert the O-ring to the water inlet pipe assembly and coat the outer circumference of the O-ring with water.



**►D◄ DETONATION SENSOR INSTALLATION**



**►E◄ GASKET/WATER PASSAGE ASSEMBLY INSTALLATION**

Bend the tabs onto the water passage assembly. Then install the water passage assembly to the cylinder head so that the gasket doesn't slip.

# ENGINE ASSEMBLY

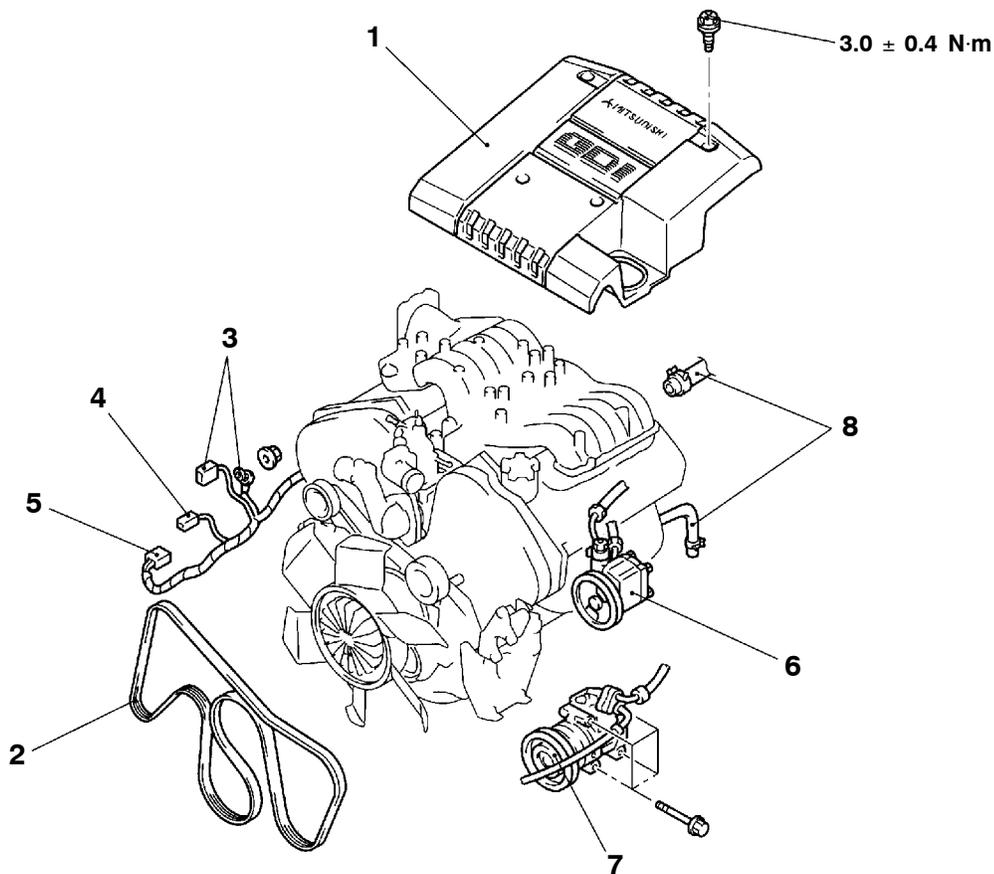
## REMOVAL AND INSTALLATION

### Caution

\*: Indicates parts which should be initially tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

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

- Hood Removal and Installation (Refer to GROUP 42 - Hood.)
- Skid Plate and Under Cover Removal and Installation
- Fuel Discharge Prevention (Pre-removal operation)
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Air Cleaner and Air Intake Hose Removal and Installation (Refer to GROUP 15 - Air Cleaner.)
- Battery, Battery Tray and Bracket Removal and Installation
- Radiator Removal and Installation (Refer to GROUP 14 - Radiator.)
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Front Exhaust Pipe Removal (Refer to GROUP 15 - Exhaust Pipe and Main Muffler.)
- Transmission Assembly Removal and Installation (Refer to GROUP 22,23 - Transmission Assembly.)



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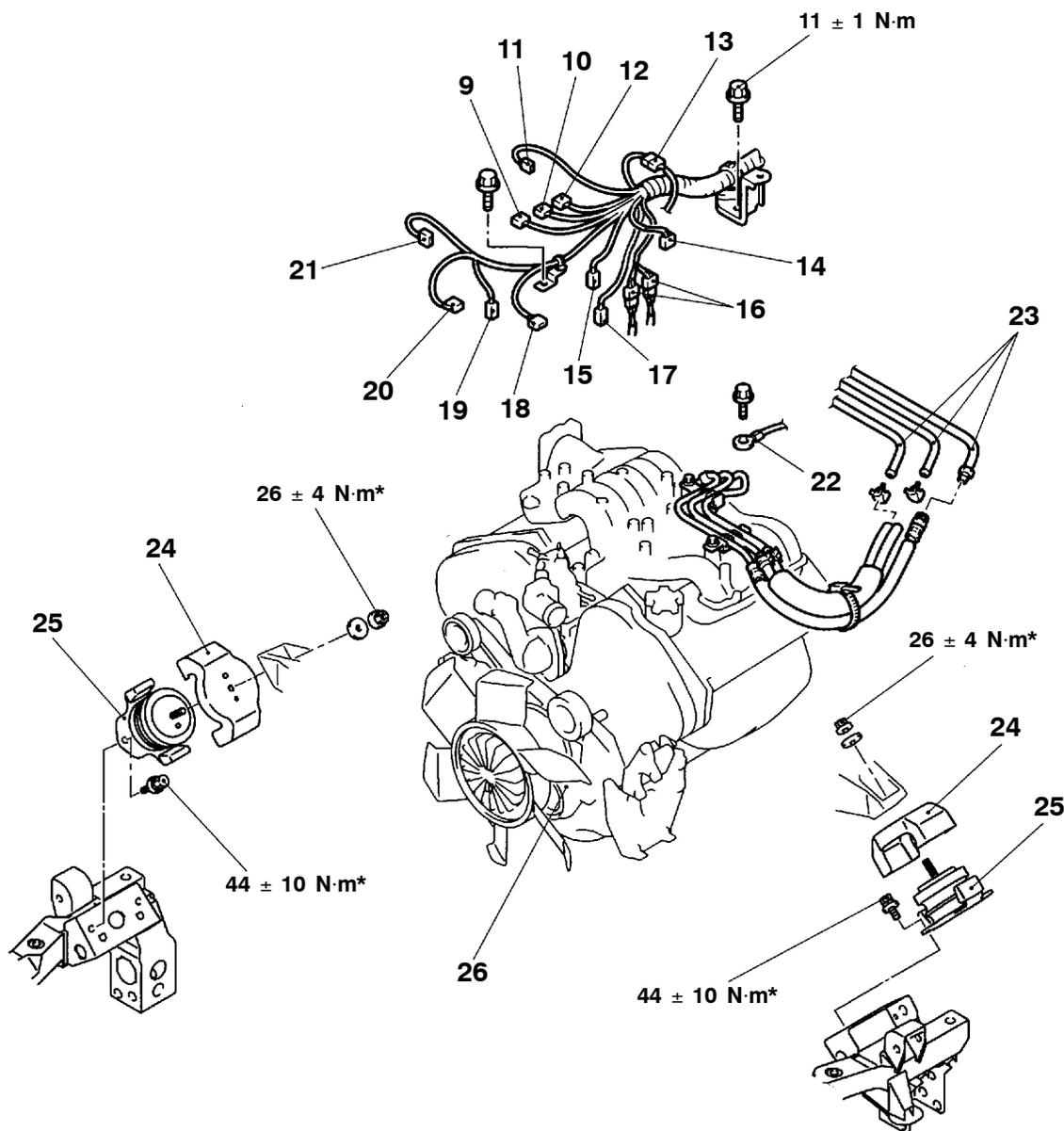
#### Removal steps



1. Engine cover
2. Drive belt
3. Alternator connector
4. Starter motor connector



5. Freewheel engage switch connector
6. Power steering oil pump assembly
7. A/C compressor assembly
8. Heater hose connection



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X0393CA  
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- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>9. Ignition failure sensor connector</li> <li>10. Detonation sensor connector</li> <li>11. Throttle position sensor connector</li> <li>12. Control wiring harness and injector wiring harness connection</li> <li>13. Control wiring harness and ignition wiring harness connection</li> <li>14. Fuel pressure sensor harness, camshaft position sensor harness and control wiring harness injector wiring harness connection</li> <li>15. Purge control solenoid valve connector</li> <li>16. Control wiring harness and battery cable connection</li> </ul> | <ul style="list-style-type: none"> <li>17. Oxygen sensor connector</li> <li>18. Crank angle sensor connector</li> <li>19. Engine coolant temperature gauge unit connector</li> <li>20. Engine coolant temperature sensor connector</li> <li>21. Throttle valve control servo connector</li> <li>22. Battery cable connection</li> <li>23. Fuel pipe and hose connection</li> <li>24. Heat protector</li> <li>25. Engine front mount insulator</li> <li>26. Engine assembly</li> </ul> |
|--|---|



**REMOVAL SERVICE POINTS****◀A▶ POWER STEERING OIL PUMP ASSEMBLY AND A/C COMPRESSOR ASSEMBLY REMOVAL**

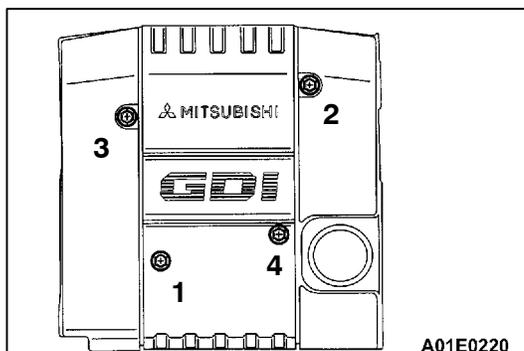
1. Remove the oil pump and A/C compressor (with the hose attached).
2. Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

**◀B▶ ENGINE ASSEMBLY REMOVAL**

1. Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
2. Lift the special tool (MB991683) and chain block slowly to remove the engine assembly upward from the engine compartment.

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

Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.

**▶B◀ ENGINE COVER INSTALLATION**

Install the engine cover bolts finger-tight, and tighten them to the specified torque in the order shown.

**Tightening torque:  $3.0 \pm 0.4$  N·m**