
ENGINE

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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

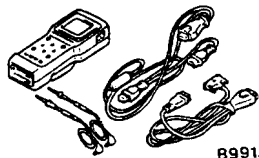
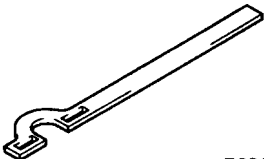
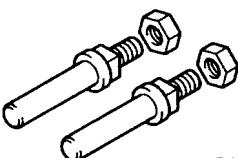
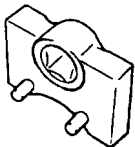
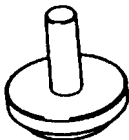
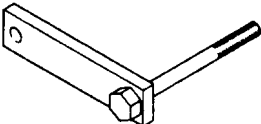
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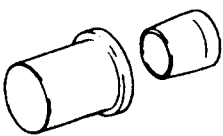
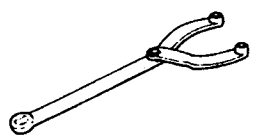
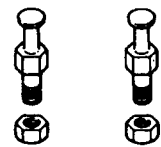
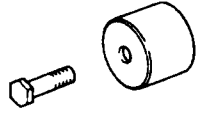
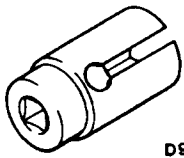
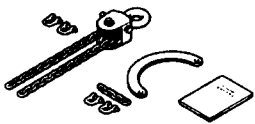
*2: Indicates the value when more than 4 minutes have passed since the engine was started.

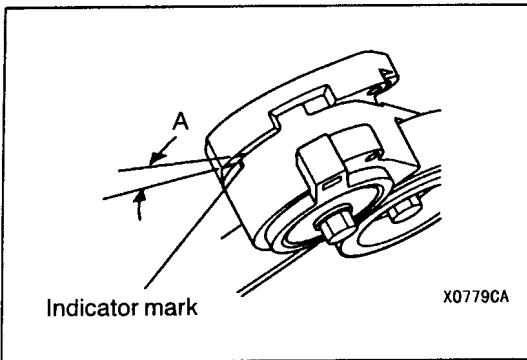
SEALANT

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	• Checking the ignition timing • Checking the idle speed • Erasing diagnosis code
 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
 D998773	MD998773	Detonation sensor wrench	Detonation sensor removal and installation
 B991683	MB991683	Sling chain set	Removal and installation of engine assembly



ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

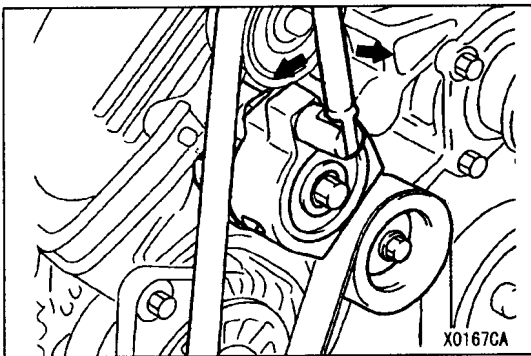
Caution

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.

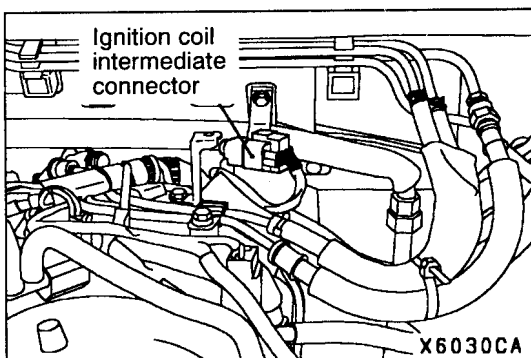
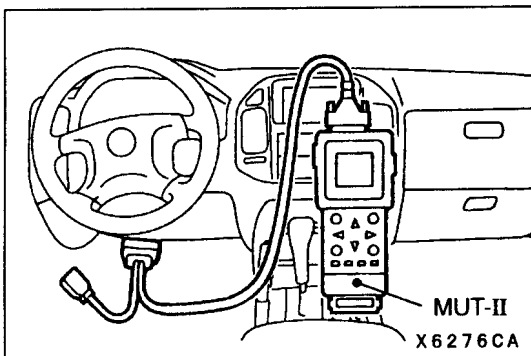


AUTO-TENSIONER CHECK

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: $5^{\circ}\text{BTDC} \pm 3^{\circ}$

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

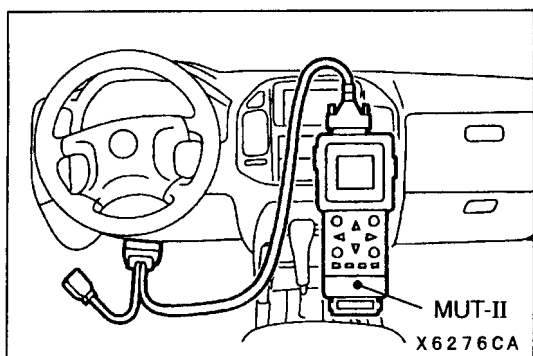
If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

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 $\pm 7^{\circ}\text{BTDC}$. 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: $5^{\circ}\text{BTDC} \pm 3^{\circ}$

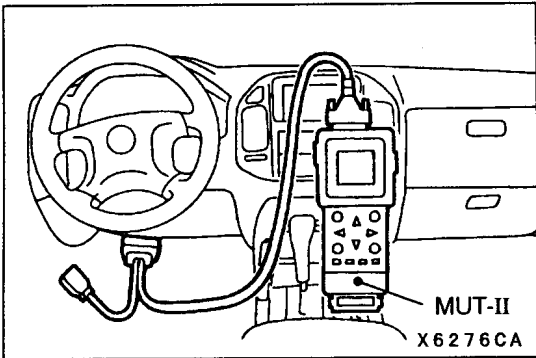
4. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

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

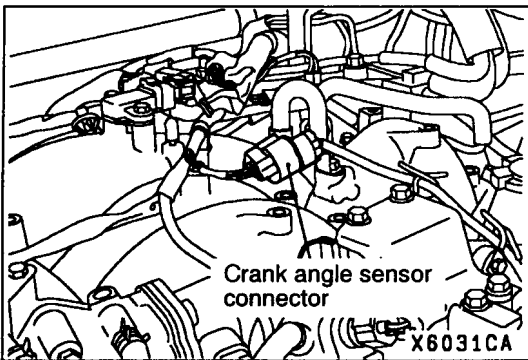
CO contents: 0.5% or less

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

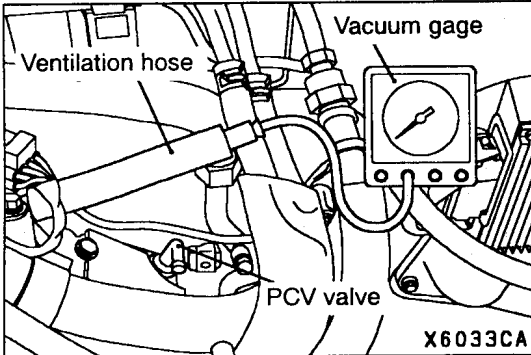
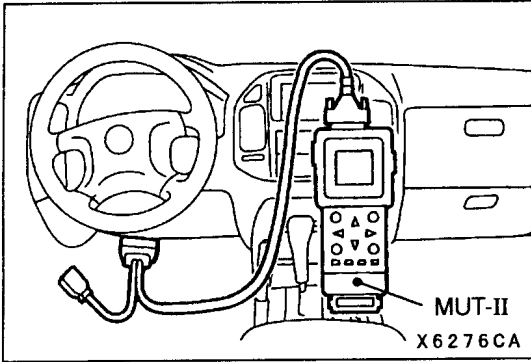
7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

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

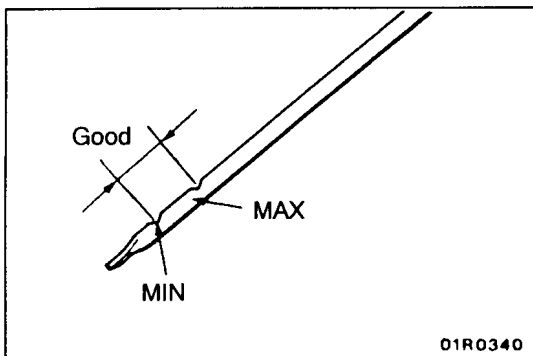
If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

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

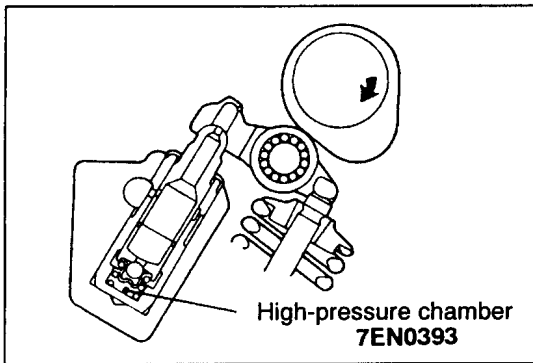
1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the 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.

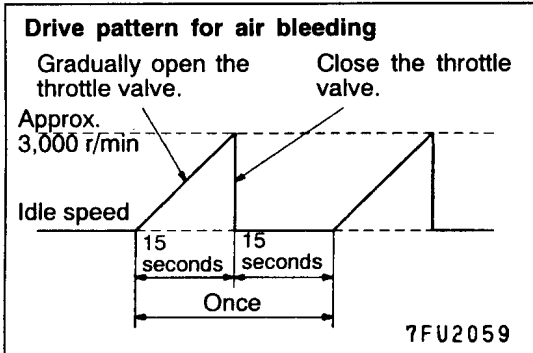
NOTE

- (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.



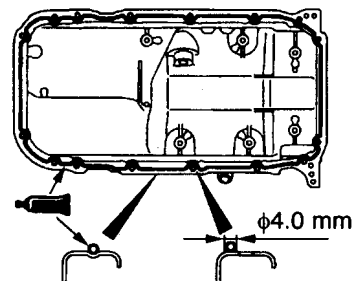
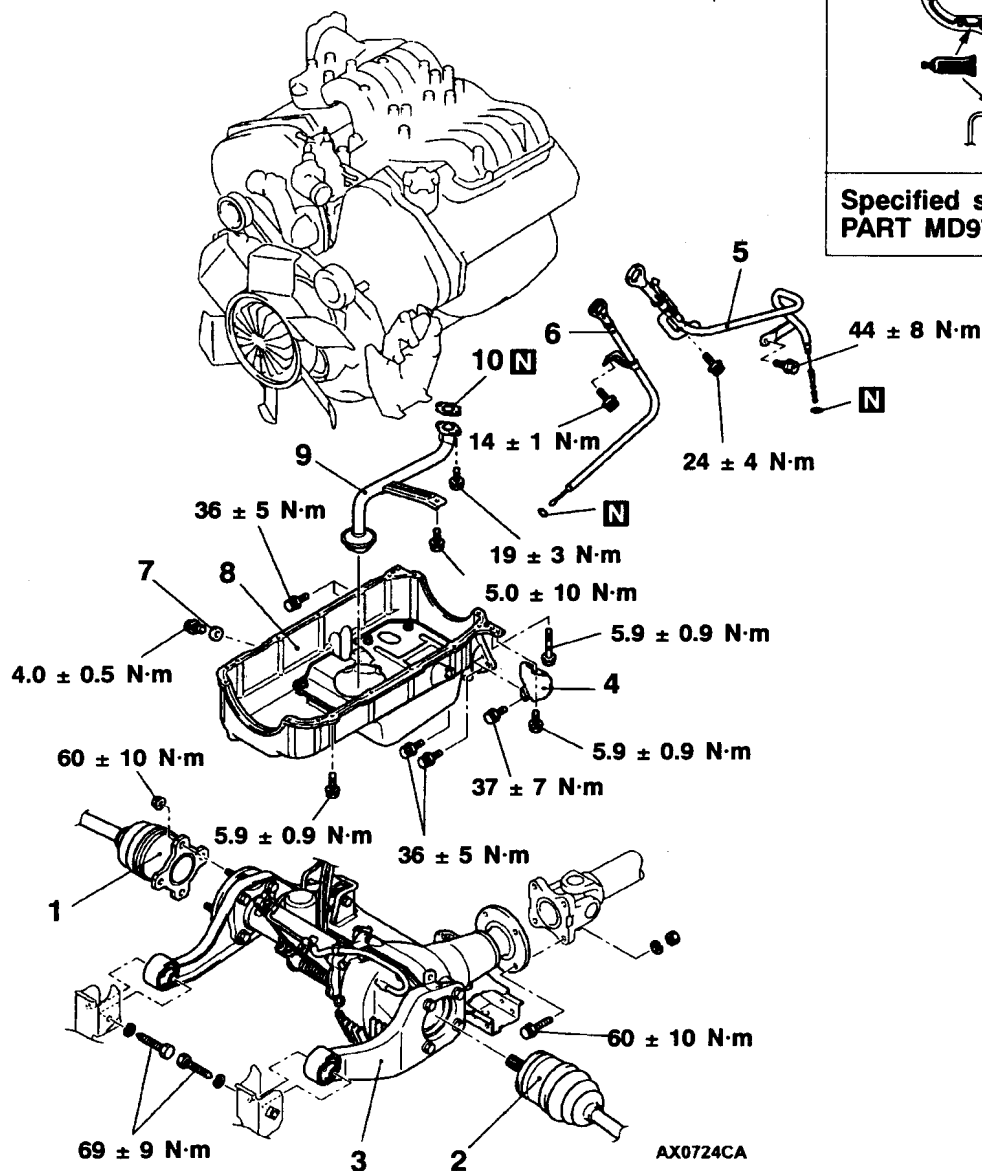
2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level 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

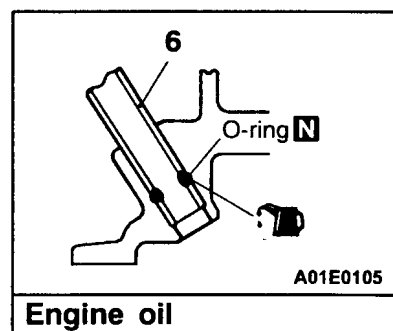
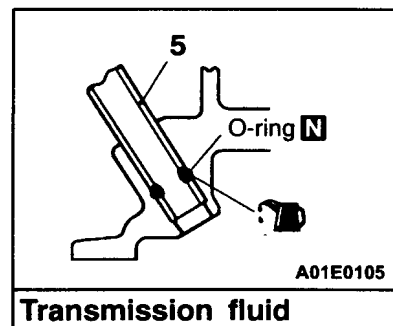
REMOVAL AND INSTALLATION

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.)



Specified sealant: MITSUBISHI GENUINE PART MD970389 or equivalent

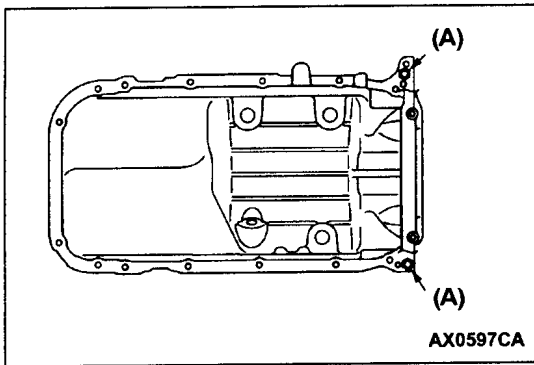


Removal steps

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

◀▶ 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

▶▶ 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

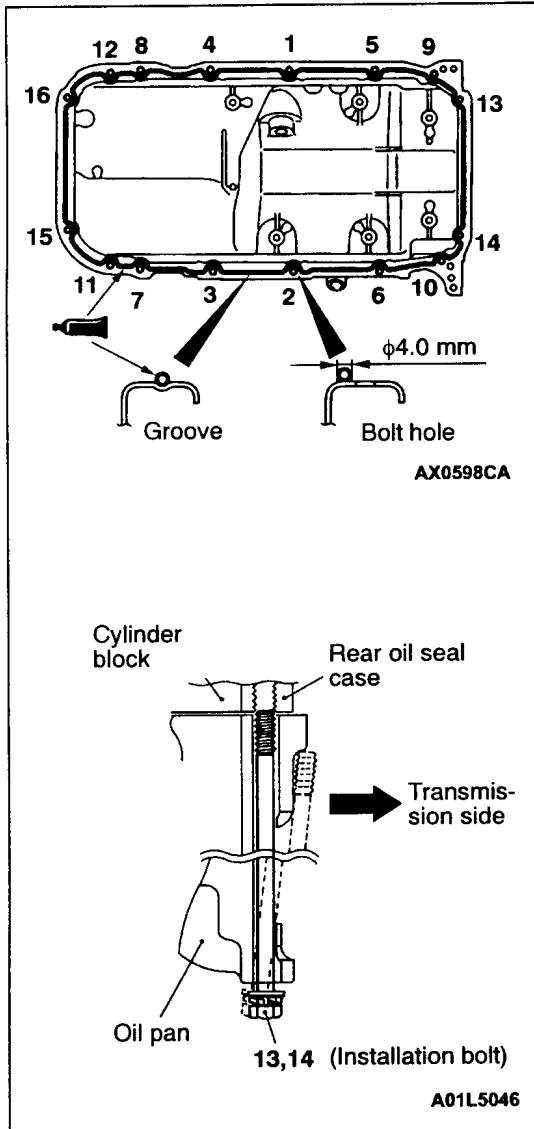
The sealant should be applied in a continuous bead approximately 4.0 mm in diameter.

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.

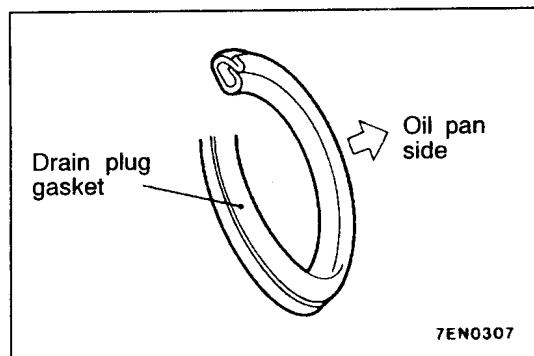


▶▶ DRAIN PLUG GASKET INSTALLATION

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.



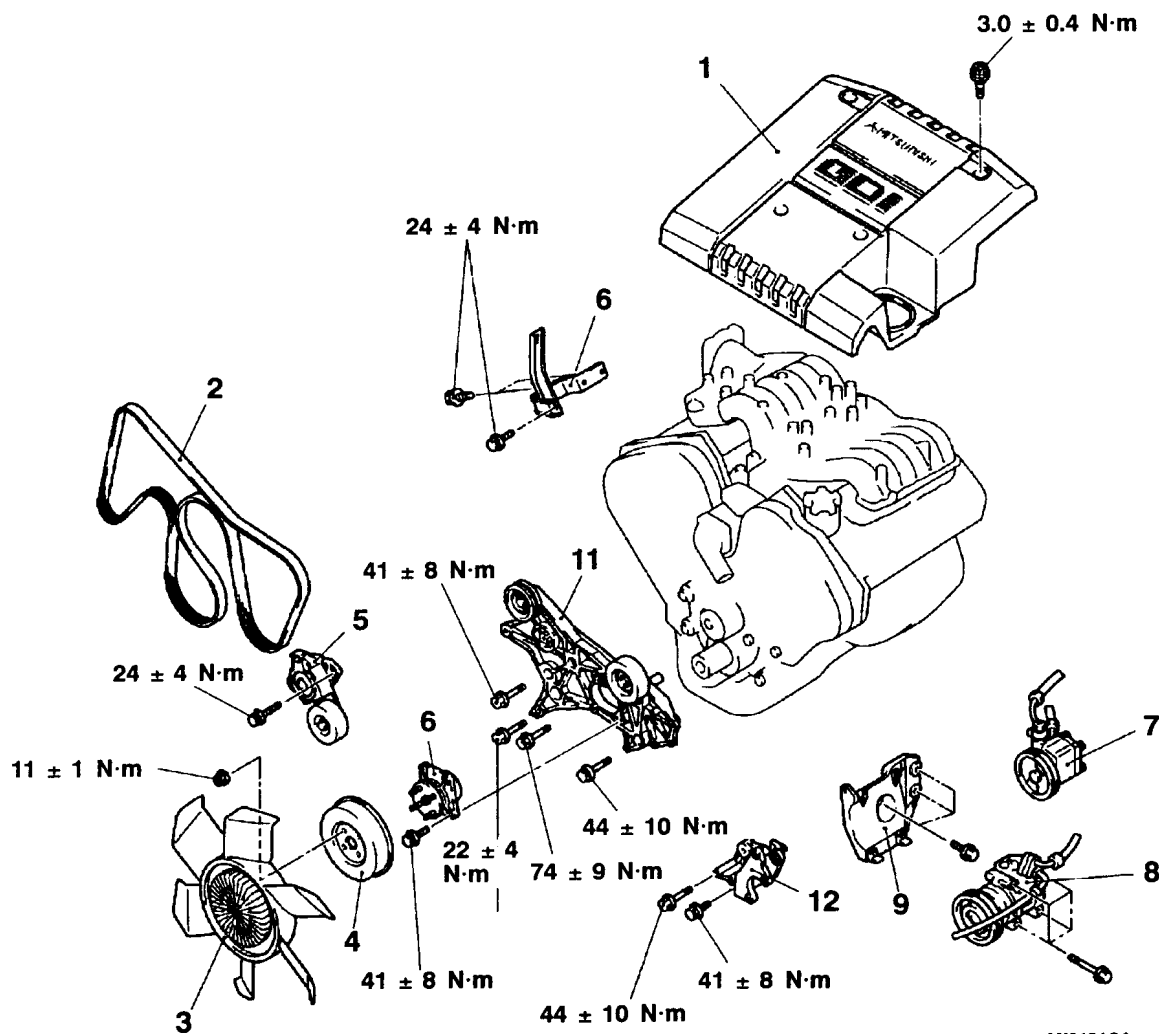
TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal Operation

- Skid Plate and Under Cover Removal and Installation
- Battery abd batterytray 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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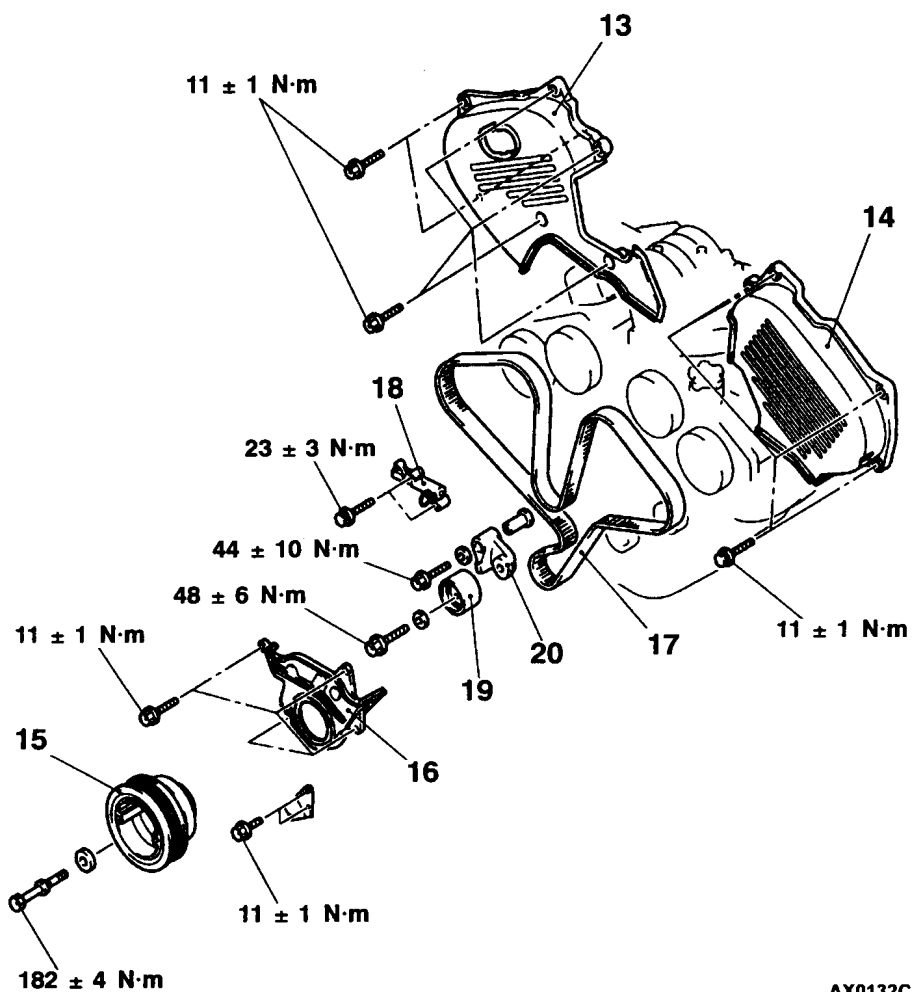
Removal steps

1. Cover
2. Drive belt
3. Cooling fan and fan clutch assembly
4. Cooling fan pulley
5. Drive belt auto-tensioner
6. Engine hanger <R.H.>
 - Alternator (Refer to Group16.)



7. Power steering oil pump assembly
8. A/C compressor assembly
9. Compressor bracket
10. Cooling fan bracket
11. Accessory mount assembly
12. Power steering oil pump bracket





AX0132CA

Removal steps

13. Timing belt upper cover assembly
<R.H.>

14. Timing belt upper cover assembly
<L.H.>

◀C▶ ▶C▶ 15. Crankshaft pulley

◀D▶ ▶B▶
▶A▶

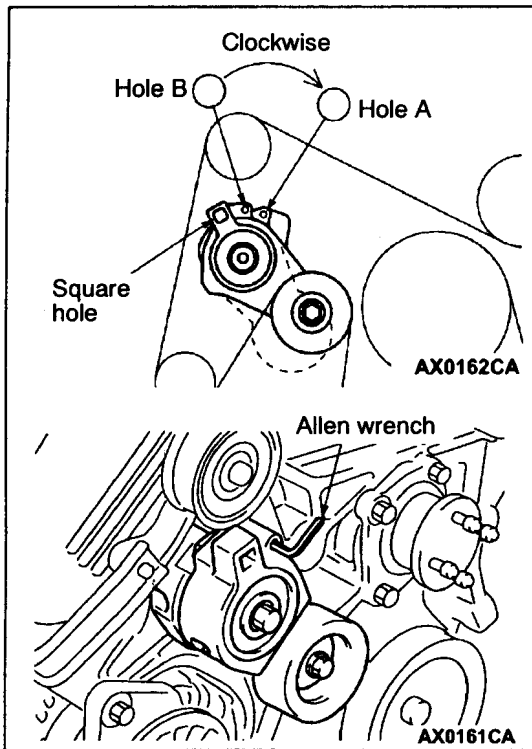
16. Timing belt lower cover assembly

17. Timing belt

18. Auto-tensioner

19. Tension pulley

20. Tensioner arm assembly

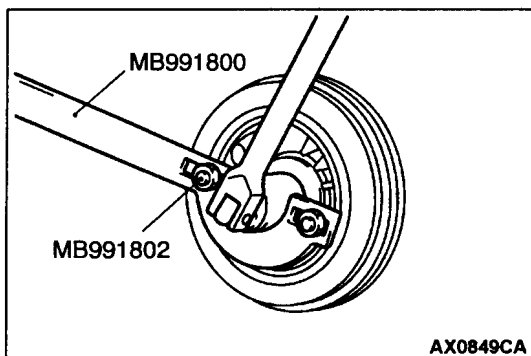
**REMOVAL SERVICE POINTS****◀A▶ DRIVE BELT AUTO-TENSIONER REMOVAL**

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

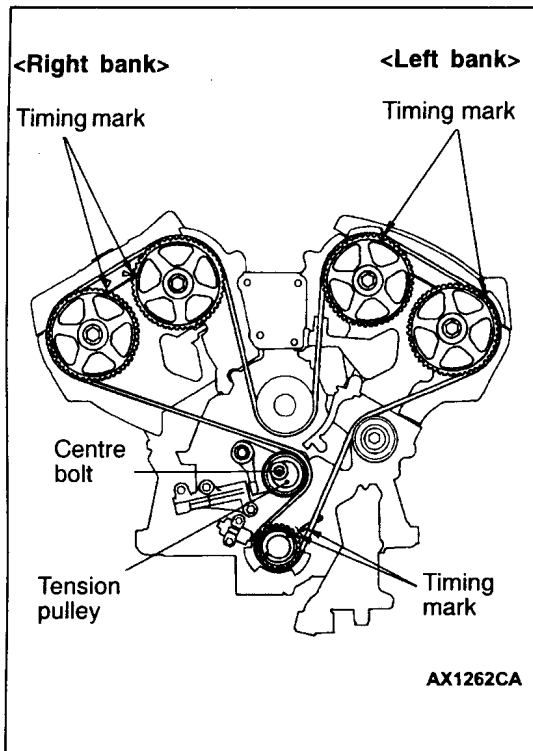
1. Insert a 12.7 mm spinner handle into the square hole on the drive belt auto tensioner, and rotate it clockwise until the tensioner touches the stopper.
2. Align hole B with hole A, and insert a 5.0 mm Allen wrench to hold the tensioner. Then loosen the drive belt, and then remove the drive belt auto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



◀A▶ 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.

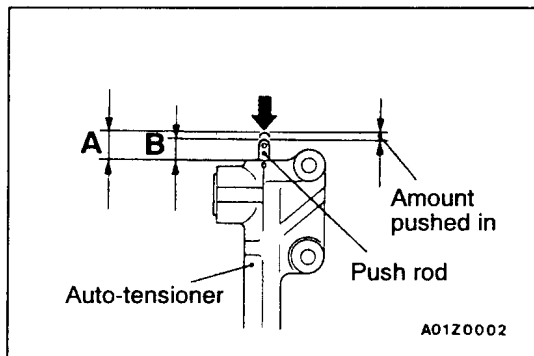
Standard value: Within 1 mm

A: Length when no force is applied

B: Length when force is applied

A – B: Amount pushed in

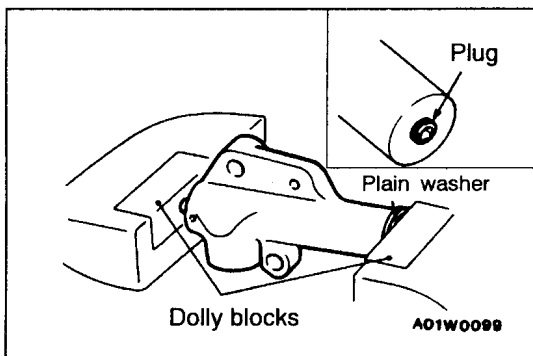
2. If it is not within the standard value, replace the auto-tensioner.

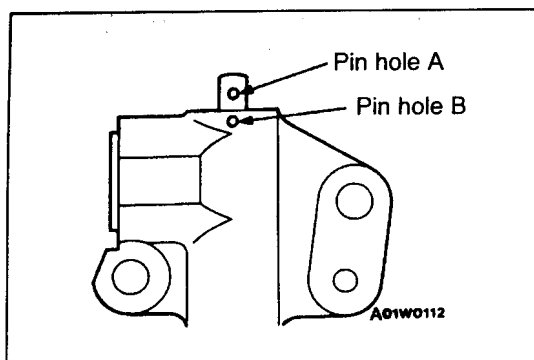


3. Place two dolly blocks in a vice as shown in the illustration, and then place the auto-tensioner in the vice.

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.





4. 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.

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

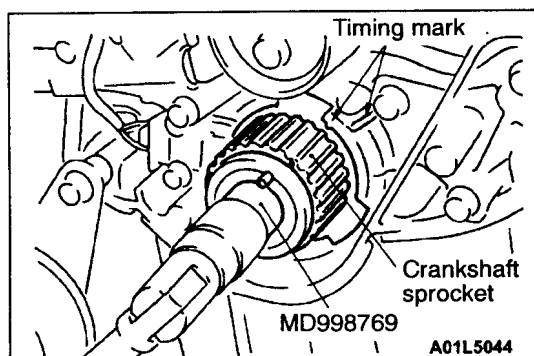
NOTE

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

6. Install the auto-tensioner to the engine.

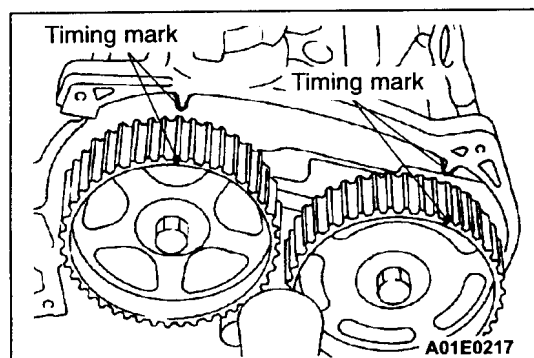
Caution

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

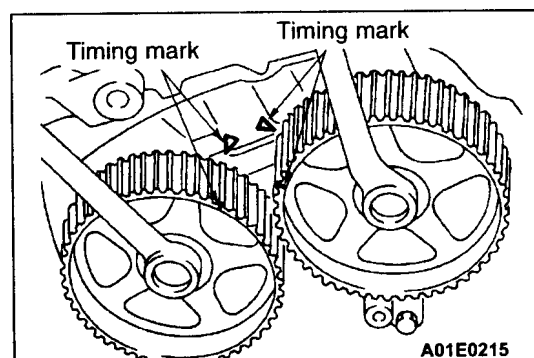


►B◀ TIMING BELT INSTALLATION

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



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

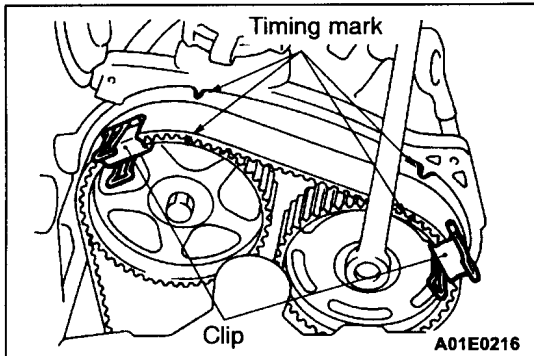


3. Align the timing marks on the left bank side crankshaft sprocket, and then hold the sprocket with a wrench as shown.

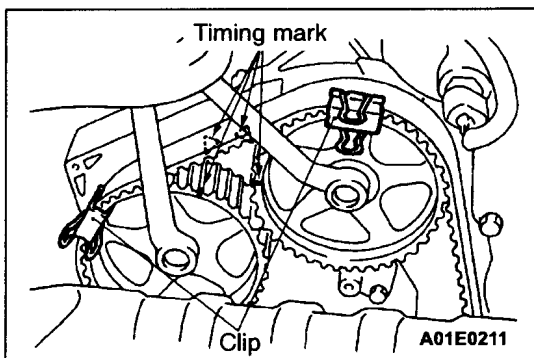
Caution

- (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.**

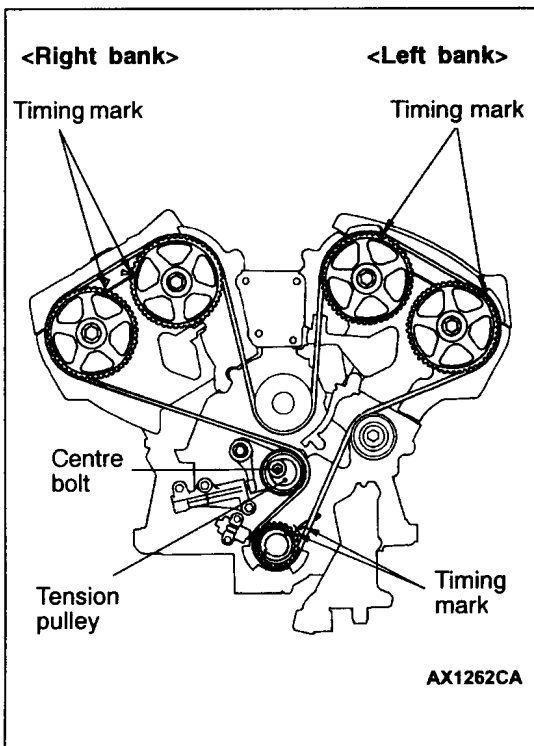
- (2) If the sprocket on one side of the left bank is turned one full revolution while the sprocket timing marks on the opposite side of the left bank are aligned, the intake and exhaust valves will interfere.



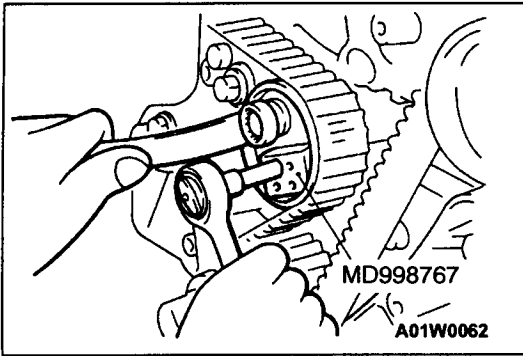
4. Set the timing belt onto the crankshaft sprocket.
5. Set the timing belt onto the idler pulley.
6. Check that the timing marks of the left bank side exhaust camshaft sprocket is aligned, and clamp the timing belt with a clip.
7. Set the timing belt onto the water pump pulley.



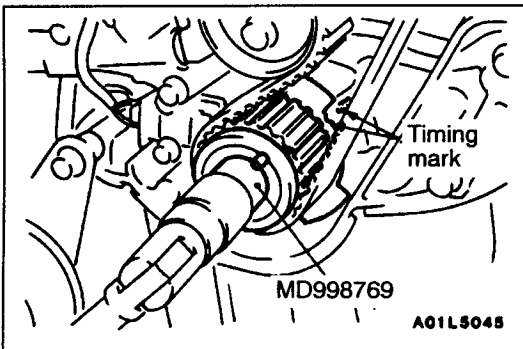
8. Check that the timing marks of the right bank side exhaust camshaft sprocket is aligned, and clamp the timing belt with a clip.
9. Set the timing belt onto the tension pulley.



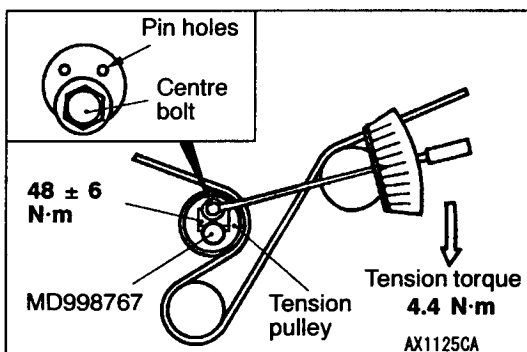
10. Turn the right bank side camshaft sprocket (exhaust side) anticlockwise until the tension side of the timing belt is firmly stretched. Check all timing marks again.



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.



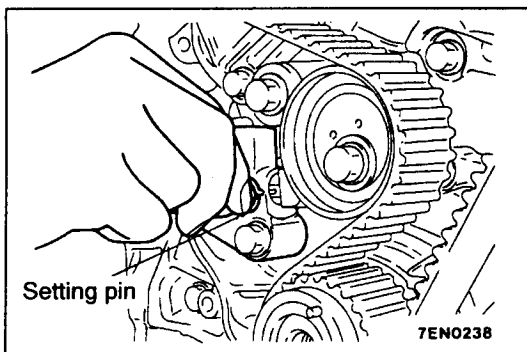
14. Loosen the centre bolt of the tensioner pulley. Use special tool and a torque wrench to apply the standard torque to the timing belt as shown in the illustration. Then tighten the centre bolt to the specified torque.

Standard value: 4.4 N·m

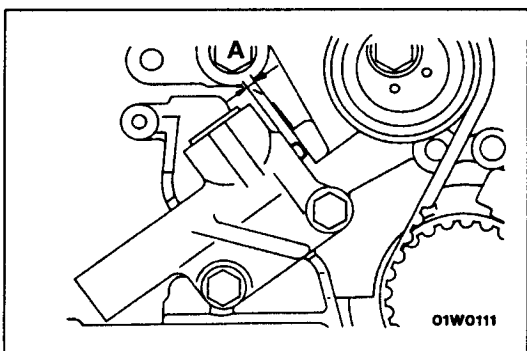
<Timing belt tension torque>

Caution

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



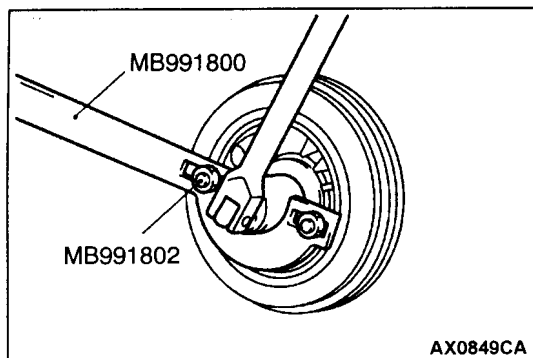
15. Remove the setting pin that has been inserted into the auto-tensioner.
16. Turn the crankshaft two turns clockwise to align the timing marks.



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

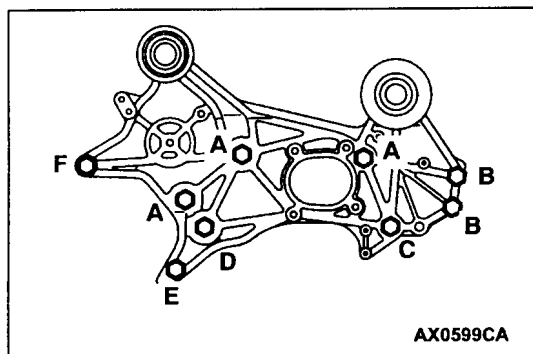
Standard value (A): 3.8 – 5.0 mm

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

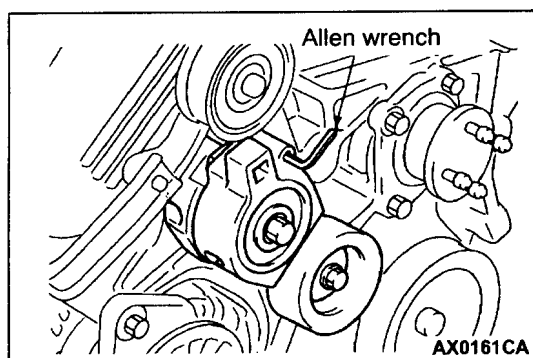
Use special tools MD991800 and MB991802 to install the crankshaft pulley.



►D◄ ACCESSORY MOUNT ASSEMBLY INSTALLATION

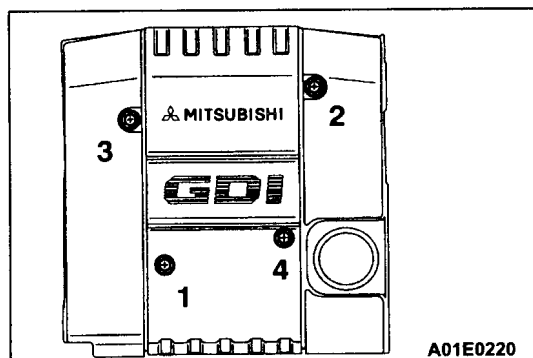
Install the bolts to the shown positions, and tighten them to the specified torque.

Bolt (symbol)	Diameter × length mm	Tightening torque(N·m)
A	10×100	41 ± 8
B	10×30	41 ± 8
C	10×100	44 ± 10
D	12×100	74 ± 9
E	8×30	22 ± 4
F	10×106	44 ± 10



►E◄ DRIVE BELT AUTO TENSIONER INSTALLATION

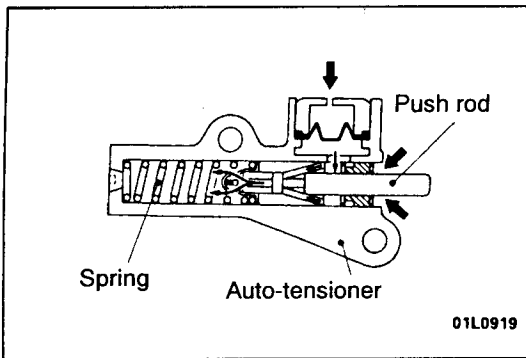
1. Install the drive belt auto tensioner with the Allen wrench inserted.
2. After the drive belt has been installed, remove the Allen wrench while holding the drive belt auto tensioner with a socket wrench drive. Then release the drive belt auto tensioner slowly.



►F◄ ENGINE COVER INSTALLATION

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

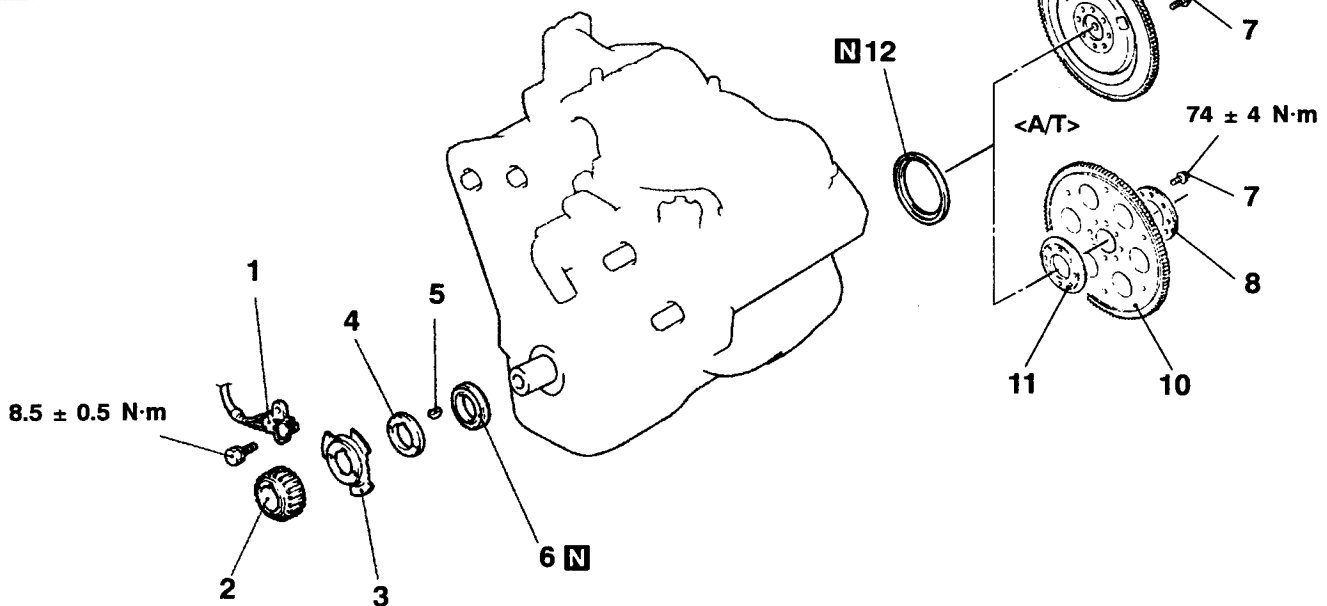
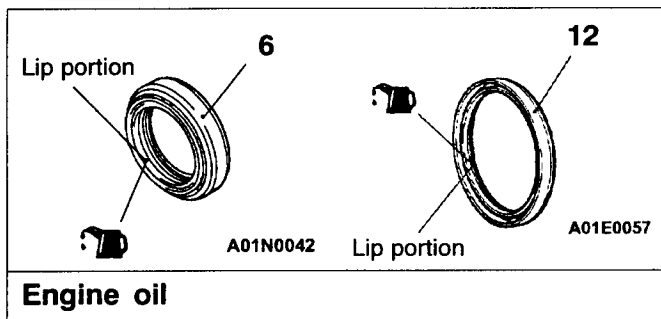
Tightening torque: 3.0 ± 0.4 N·m

**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.)

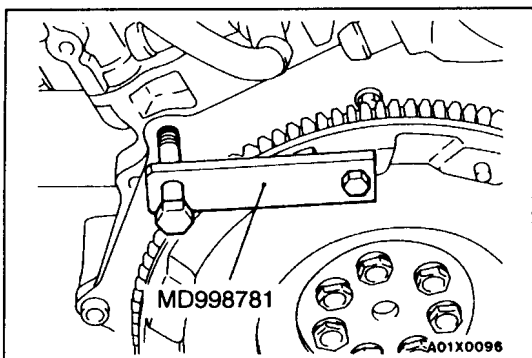


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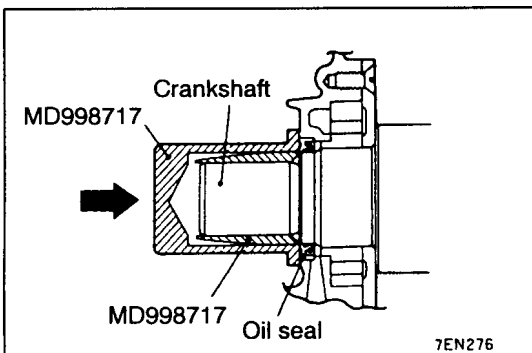
Removal steps

- ▶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

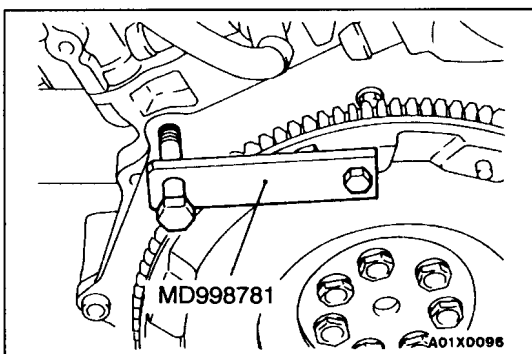
- ◀A▶ ▶B◀ 7. Bolt
 ▶A▶ 8. Adaptor plate
 ▶A▶ 9. Flywheel
 ▶A▶ 10. Drive plate
 ▶A▶ 11. Crankshaft adaptor
 ▶A▶ 12. Crankshaft rear oil seal

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

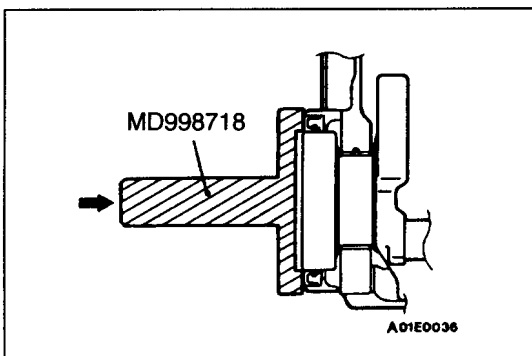
Use special tool to secure the flywheel or drive plate and remove the bolt.

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

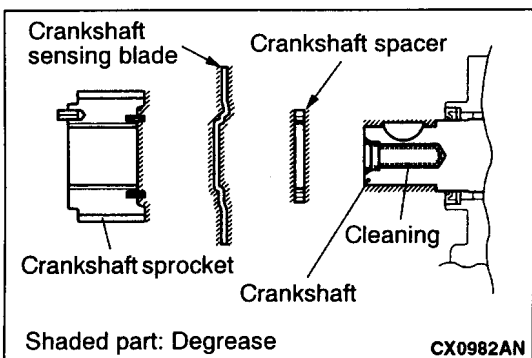
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Use special tool to tap in the oil seal as shown in the illustration.

**▶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**

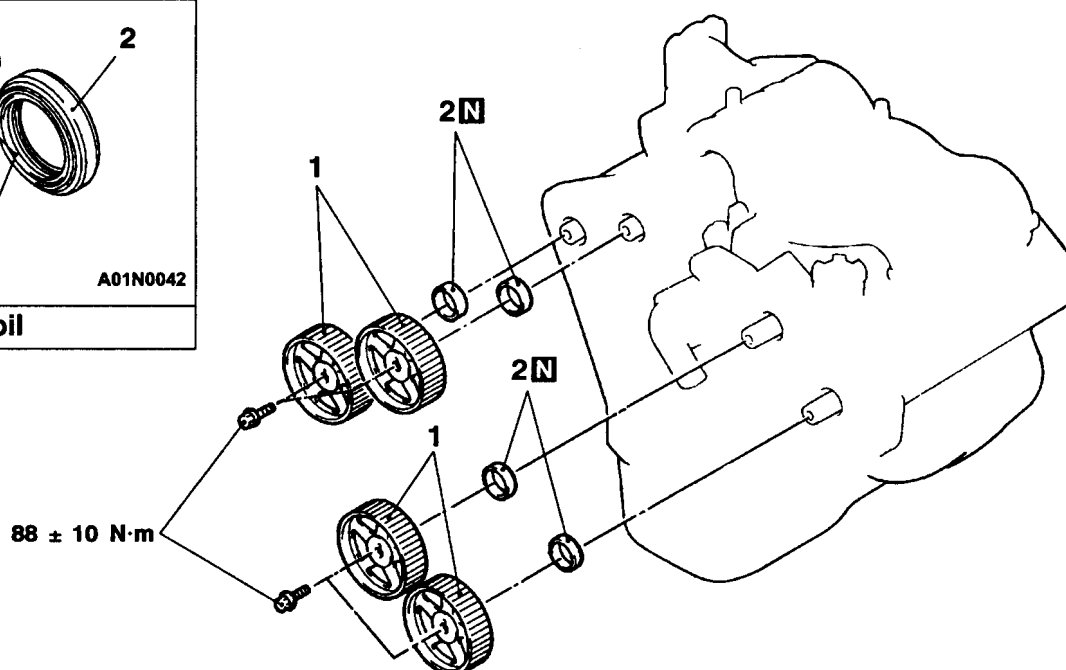
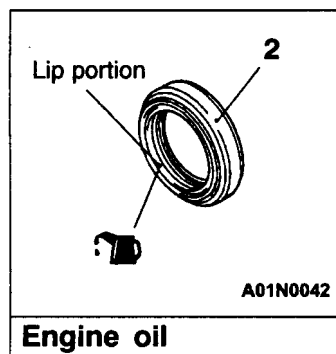
To prevent the crankshaft pulley mounting bolt from loosening, degrease or clean the crankshaft, the crankshaft spacer, the crankshaft sensing blade and the crankshaft at the shown positions.

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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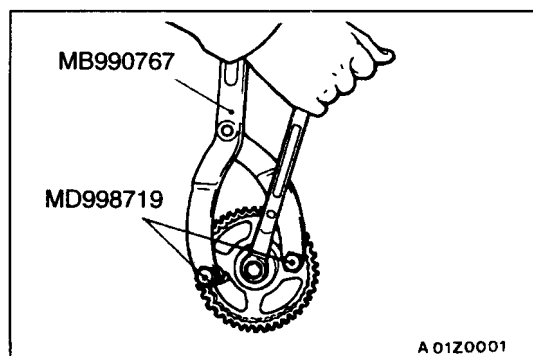
Removal steps

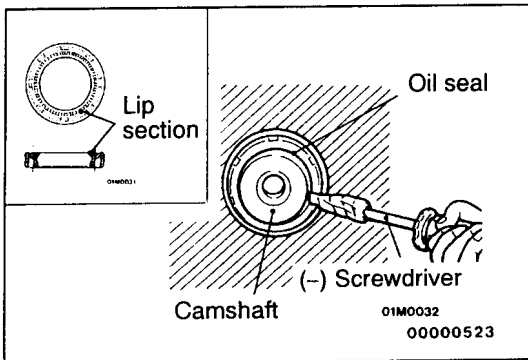
- ◀A▶ ▶B▶ 1. Camshaft sprocket
▶B▶ ▶A▶ 2. Camshaft oil seal

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.

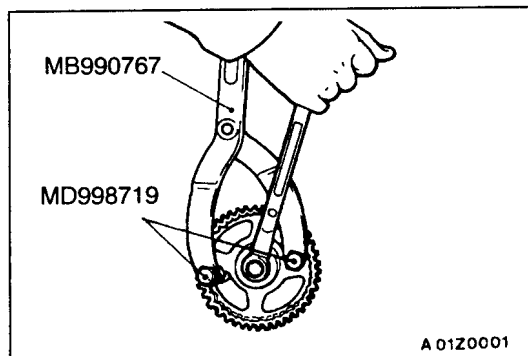
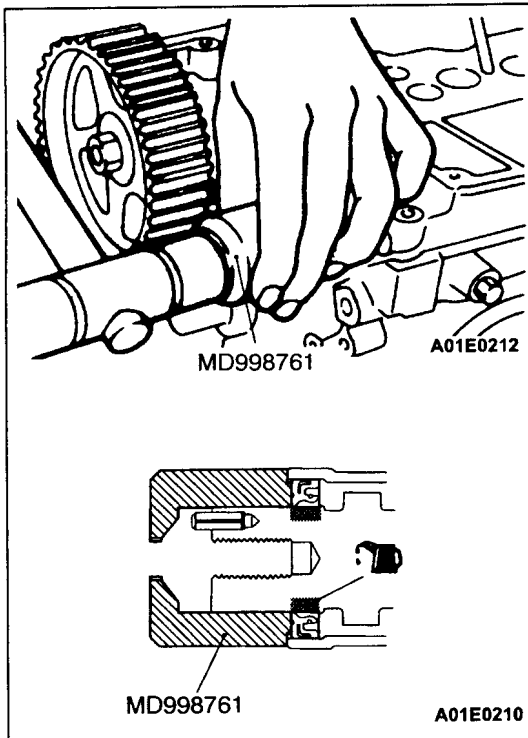
Caution

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

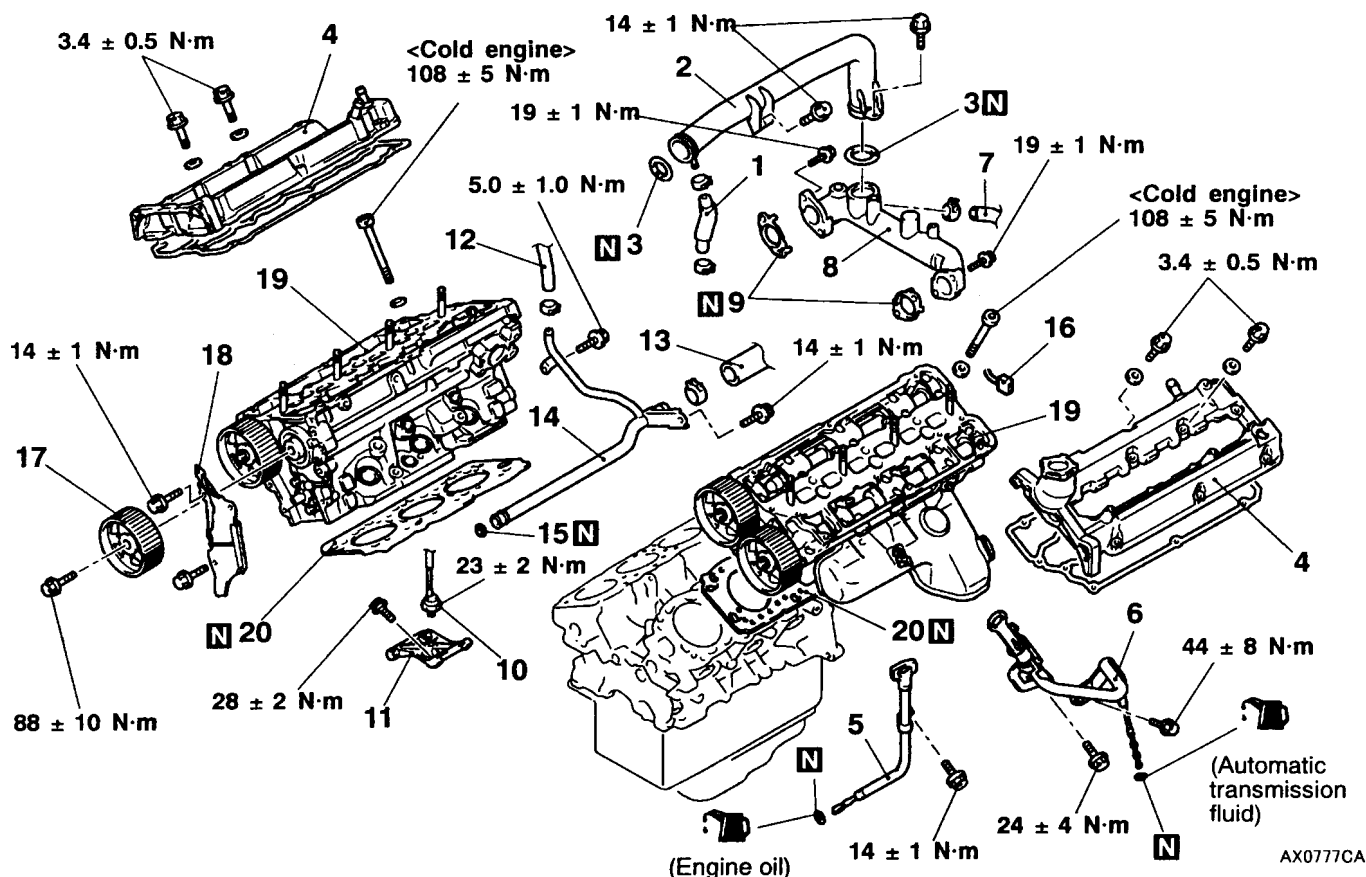
Use special tools in the same way as during removal to install the camshaft sprocket.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

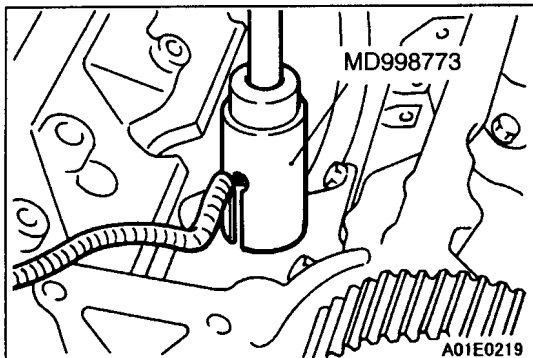
Pre-removal and Post-installation Operation

- 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.)

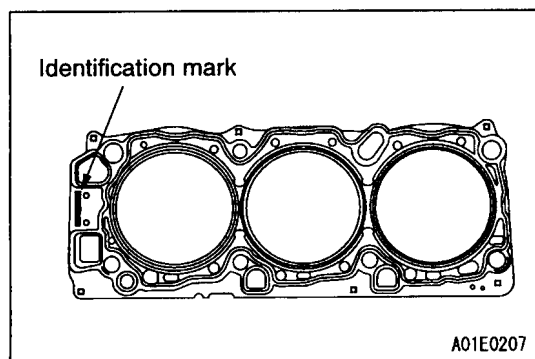
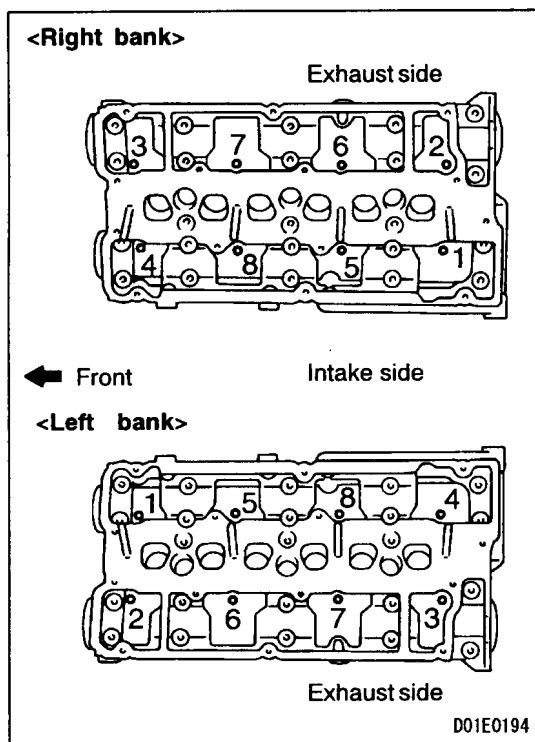


Removal steps

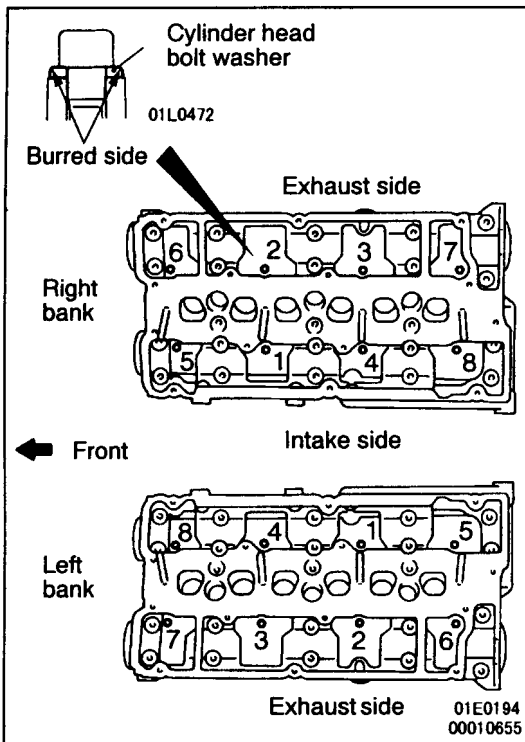
- | | | |
|-----|---|---|
| ▶C◀ | 1. Water hose | 12. Water hose connection |
| | 2. Water outlet pipe assembly | 13. Heater hose connection |
| | 3. O-ring | 14. Water pipe assembly |
| | 4. Rocker cover | ▶C◀ 15. O-ring |
| | 5. Oil dipstick assembly <when removing left bank only> | 16. Camshaft position 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◀ 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.

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

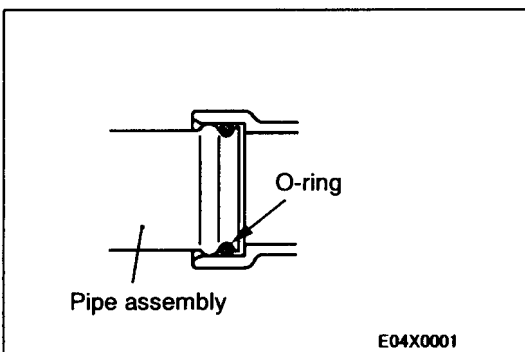
1. Degrease the cylinder head and cylinder block gasket mounting surfaces.
2. Make sure that the gasket has the proper identification mark for the engine.
3. Lay the cylinder head gasket on the cylinder block with the identification mark at the front top.

**►B◄ CYLINDER HEAD ASSEMBLY INSTALLATION**

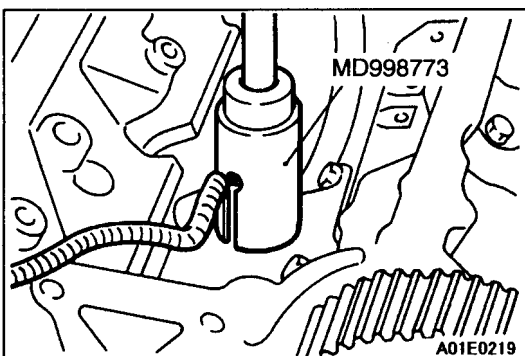
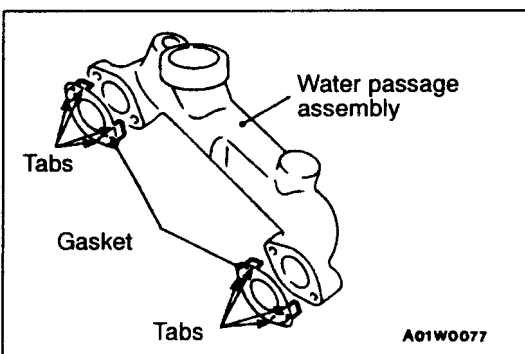
Tighten the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and install the cylinder head bolt.

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

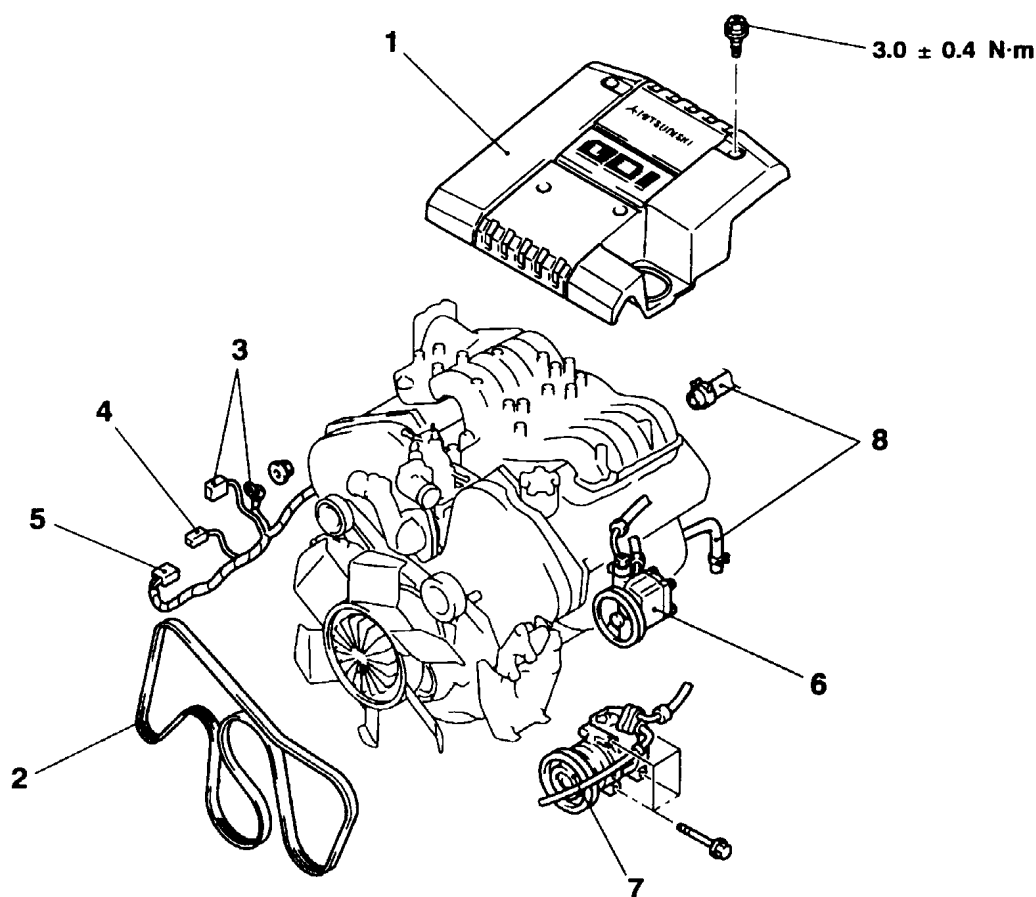
REMOVAL AND INSTALLATION

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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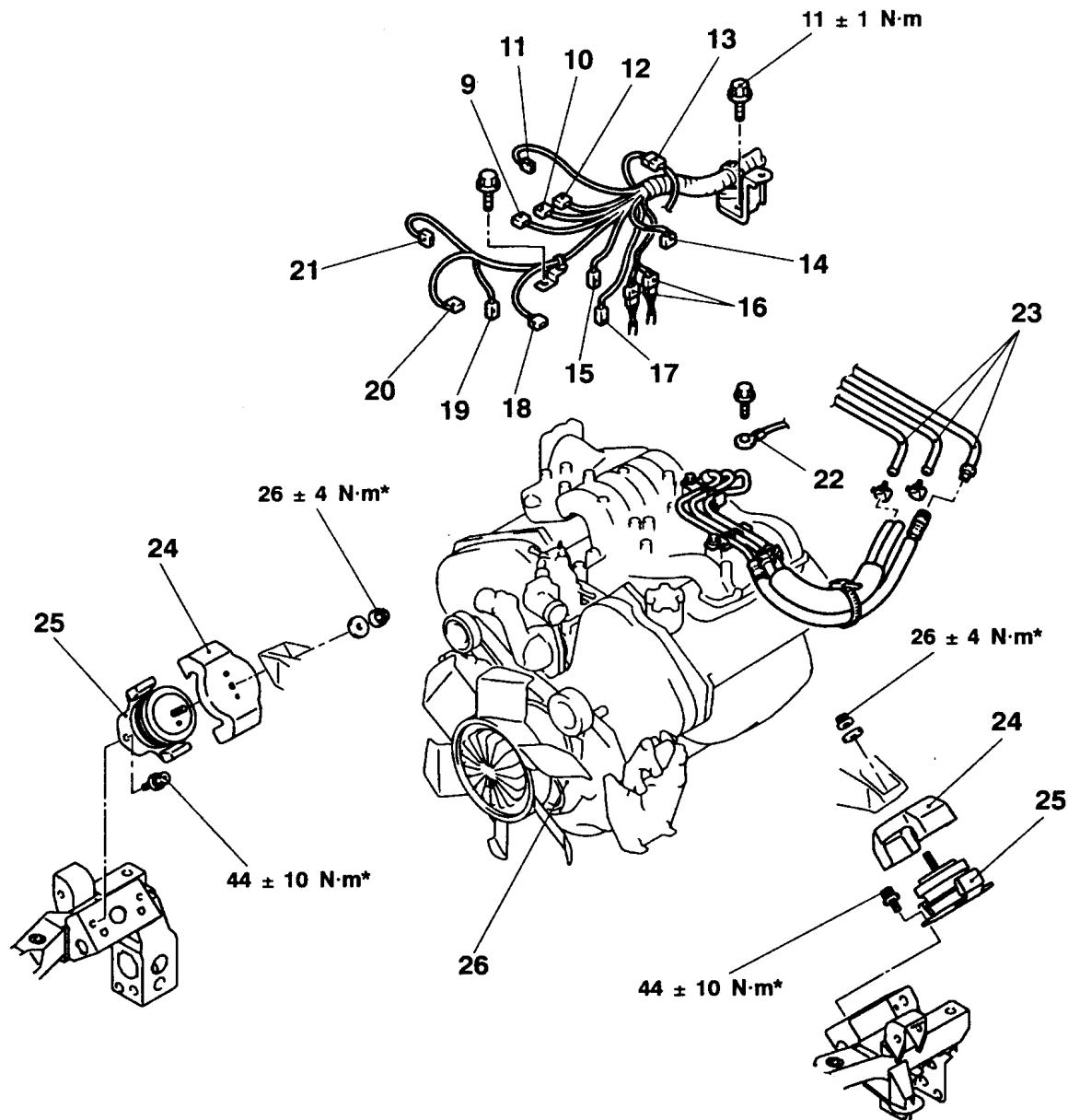
Removal steps



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 compressure assembly
8. Heater hose connection



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X0393CA
00010658

- 9. Ignition failure sensor connector
- 10. Detonation sensor connector
- 11. Throttle position sensor connector
- 12. Control wiring harness and injector wiring harness connection
- 13. Control wiring harness and ignition wiring harness connection
- 14. Fuel pressure sensor harness, camshaft position sensor harness and control wiring harness injector wiring harness connection
- 15. Purge control solenoid valve connector
- 16. Control wiring harness and battery cable connection

- 17. Oxygen sensor connector
- 18. Crank angle sensor connector
- 19. Engine coolant temperature gauge unit connector
- 20. Engine coolant temperature sensor connector
- 21. Throttle valve control servo connector
- 22. Battery cable connection
- 23. Fuel pipe and hose connection
- 24. Heat protector
- 25. Engine front mount insulator
- 26. Engine assembly

◀B▶ ▶A▶

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

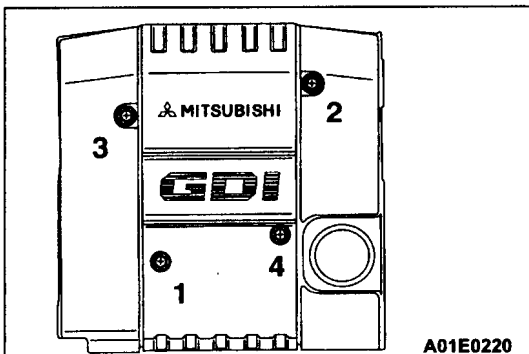
1. Remove the oil pump and A/C compressor (with the hose attached).
2. Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

◀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 ± 0.4 N·m

ENGINE <4D5>

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GENERAL INFORMATION

Items			4D56
Total displacement mL			2,477
Bore x Stroke mm			91.1 x 95.0
Compression ratio			21
Combustion chamber			Vortex chamber type
Camshaft arrangement			SOHC
Number of valve	Intake		4
	Exhaust		4
Valve timing	Intake	Opening	BTDC 20°
	Exhaust	Closing	ABDC 49°
	Intake	Opening	BBDC 55°
	Exhaust	Closing	ATDC 22°
Fuel system			Distribution type injection pump
Rocker arm			Roller type
Adjusting screw			Elephant foot type

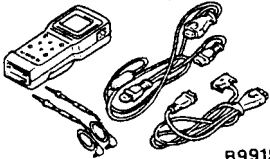
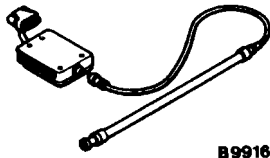
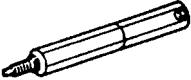
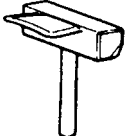
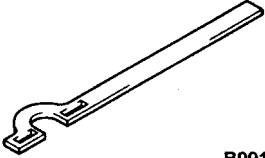
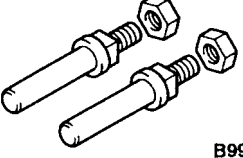
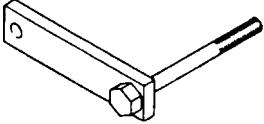
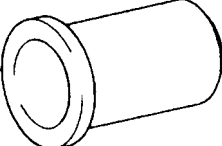
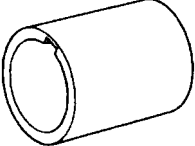
SERVICE SPECIFICATIONS

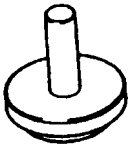
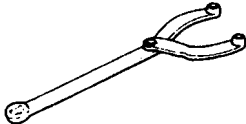
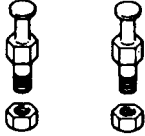
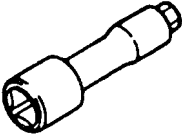
Items		Standard value	Limit
A/C compressor drive belt (When inspection)	Vibration frequency Hz	157 – 176	–
	Tension N	260 – 325	–
	Deflection mm <Reference>	8.0 – 8.5	–
A/C compressor drive belt (When adjustment)	Vibration frequency Hz	157 – 176	–
	Tension N	260 – 325	–
	Deflection mm <Reference>	8.0 – 8.5	–
A/C compressor drive belt (When replacement)	Vibration frequency Hz	192 – 208	–
	Tension N	390 – 450	–
	Deflection mm <Reference>	6.5 – 7.0	–
Valve clearance (at hot) mm		0.25	–
Injection timing (Value indicated on dial gauge mm)		9° ATDC (1 ± 0.03)	–
Idle speed r/min		750 ± 100	–
Compression pressure kPa (at engine speed of 280 r/min)		3,040	Min. 2,256
Compression pressure difference of all cylinder (at engine speed of 280 r/min) kPa		–	Max. 294
Timing belt tension mm		4 – 5	
Timing belt B tension mm		4 – 5	

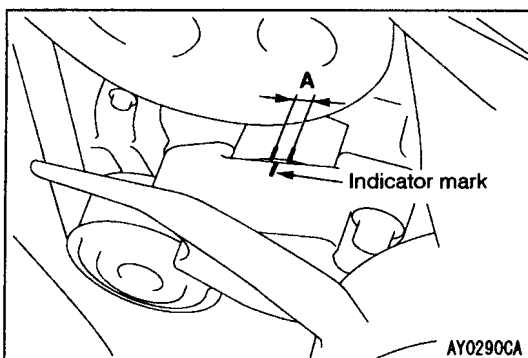
SEALANTS

Items	Specified sealant	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Semi-circular packing and rocker cover gasket seal, and cylinder head seal	3M ATD Part No. 8660 or equivalent	

SPECIAL TOOLS

Tools	Number	Name	Use
 B991502	MB991502	MUT-II sub-assembly	Drive belt tension measurements
 B991668	MB991668	Belt tension meter set	
	MD998384	Prestroke measuring adapter	Adjustment of the injection timing
	MD998727	Oil pan remover	Removal of oil pan
 B991800	MB991800	Crankshaft pulley holder	Holding the crankshaft pulley
 B991802	MB991802	Pin B	
	MD998781	Flywheel stopper	Securing the flywheel
	MD998382	Crankshaft front oil seal installer	Installing the crankshaft front oil seal
	MD998383	Crankshaft front oil seal guide	

Tools	Number	Name	Use
	MD998376	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
	MB990767	End yoke holder	Holding the camshaft sprocket
	MD998719	Crankshaft pulley holder pin	
	MD998381	Camshaft oil seal installer	Installing the camshaft oil seal
	MD998051	Cylinder head bolt wrench	Removal and installation of the cylinder head bolt



ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR AND POWER STEERING OIL PUMP DRIVE BELT TENSION CHECK

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.

A/C COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT <VEHICLES WITH A/C>

1. Check the drive belt tension by the following procedures.

Standard value:

Item	During inspection	During adjustment	During replacement
Vibration frequency Hz	157 – 176	157 – 176	192 – 208
Tension N	260 – 325	260 – 325	390 – 450
Deflection mm <Reference>	8.0 – 8.5	8.0 – 8.5	6.5 – 7.0

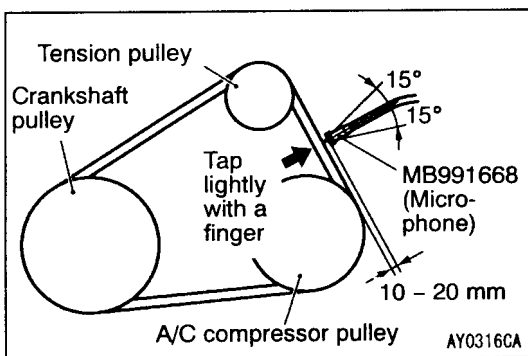
<When using MUT-II>

- (1) Connect the MUT-II to the special tool (MB991668).
- (2) Connect the MUT-II to the diagnosis connector.

Caution

Always turn the ignition switch to LOCK (OFF) position before disconnecting or connecting the MUT-II.

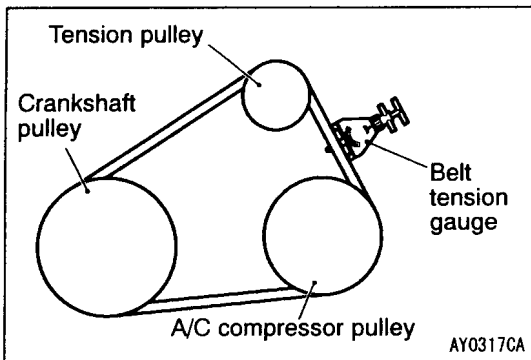
- (3) Turn the ignition switch to ON, and select the "Belt tension measurement" on the menu screen.



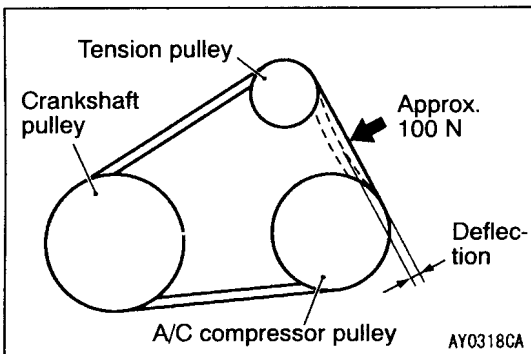
- (4) Hold a microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), approximately 10 – 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of $\pm 15^\circ$).
- (5) Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

Caution

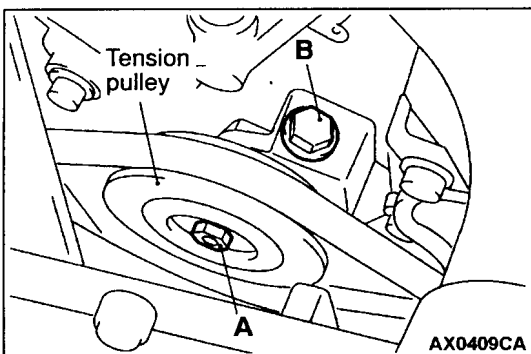
- 1) The temperature of the surface of the belt should be as close to normal temperature as possible.
- 2) Do not allow any contaminants such as water or oil to get onto the microphone.
- 3) If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values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

**<When using a tension gauge>**

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

**<When checking the deflection>**

Apply approx. 100 N 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.



2. If not within the standard value, adjust the belt tension by the following procedure.

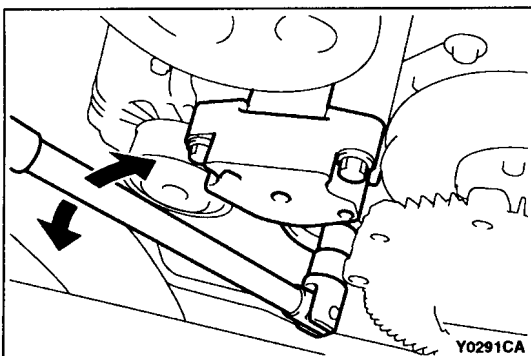
- (1) Loosen the tension pulley securing bolt A.
- (2) Use the adjusting bolt B to adjust the belt deflection.
- (3) Tighten the securing bolt A to the specified torque.

Tightening torque: 44 ± 10 N·m

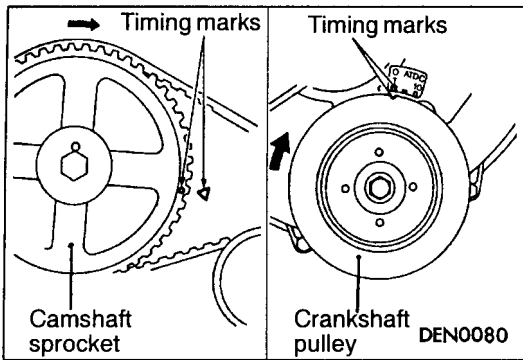
- (4) Check the belt tension, and readjust if necessary.

Caution

When checking the belt tension, turn the crankshaft clockwise one turn or more.

**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 alternator and power steering oil pump drive belt. (Refer P.11B-19.)
3. Locate a ring spanner onto the auto-tensioner pulley mounting bolt, and move the tensioner back and forth to confirm there is no stiffness.
4. If some abnormality is found during the above mentioned check (1) and (3), replace the auto-tensioner.
5. Install the alternator and power steering oil pump drive belt. (Refer P.11B-19.)

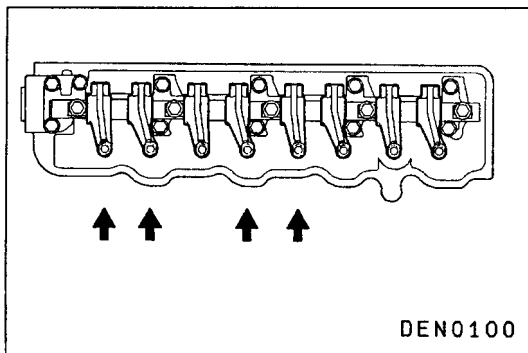


VALVE CLEARANCE CHECK AND ADJUSTMENT

1. Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 90 °C.
2. Remove the timing belt upper cover.
3. Remove the rocker cover.
4. Align the camshaft sprocket timing marks and set the No. 1 cylinder at top dead centre.

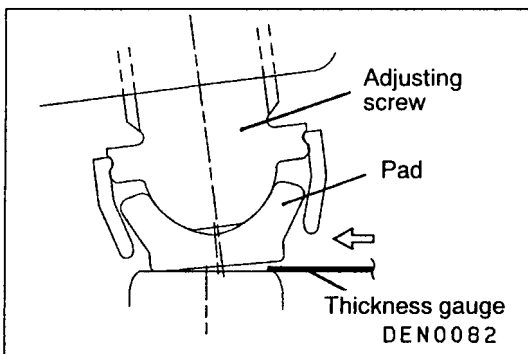
Caution

The crankshaft should always be turned in a clockwise direction.



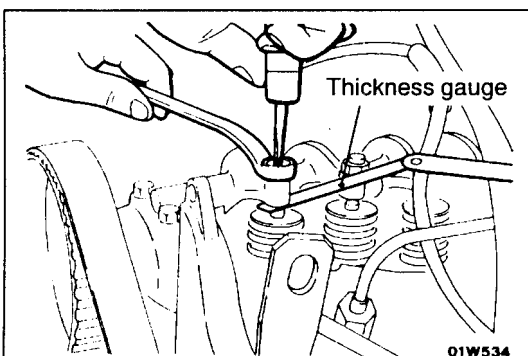
5. Measure the valve clearance at the places indicated by arrows in the illustration.

Standard value: 0.25 mm

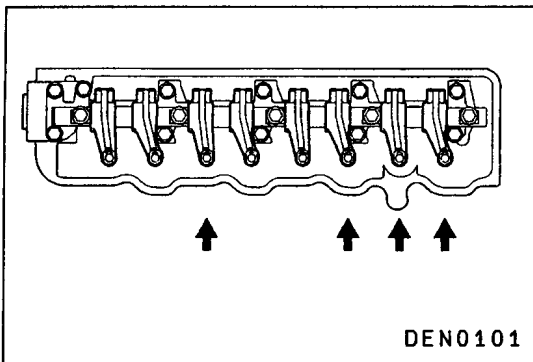


NOTE

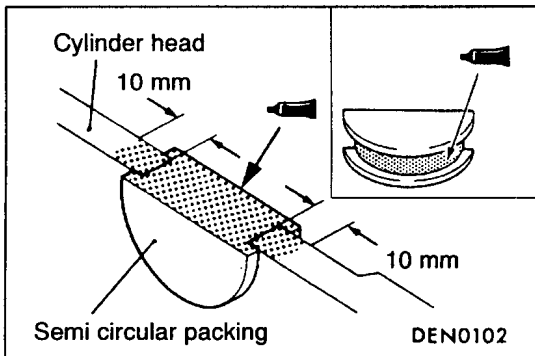
Insert the thickness gauge from the centre of the cylinder head towards the outside so that it doesn't touch the pad.



6. If the clearance is outside the standard value, loosen the lock nut of the rocker arm and adjust by turning the adjusting screw while using a thickness gauge to measure the clearance.
7. Tighten the lock nut while holding the adjusting screw with a screwdriver so that it doesn't turn.
8. Turn the crankshaft 360° clockwise to bring No. 4 cylinder to the top dead centre position.



9. Measure the valve clearances at the places indicated by arrows in the illustration. If the clearance is not within the standard value, repeat steps 7 and 8 above.



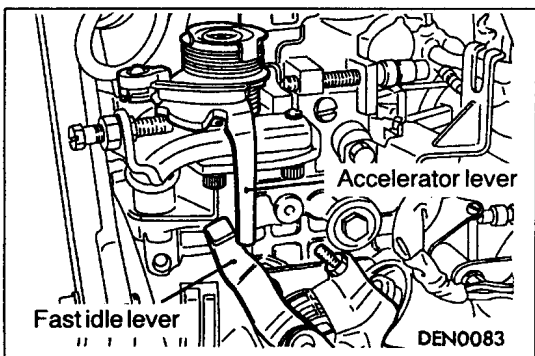
10. Apply specified sealant to the section of the semi-circular packing shown in the illustration.

Specified sealant: 3M ATD Part No. 8660 or equivalent

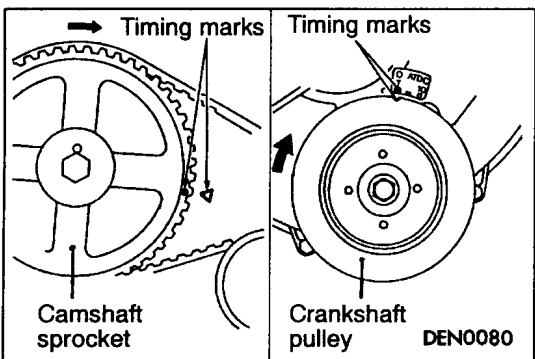
11. Install the rocker cover.
12. Install the timing belt upper cover.

INJECTION TIMING CHECK AND ADJUSTMENT

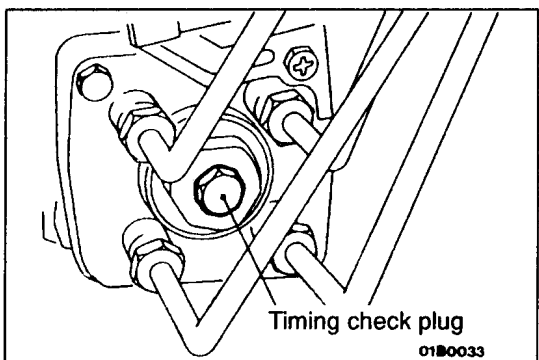
1. Warm up the engine and then check to be sure that the fast idle lever is separated from the accelerator lever.
2. Remove all of the glow plugs.
3. Remove the timing belt upper cover.

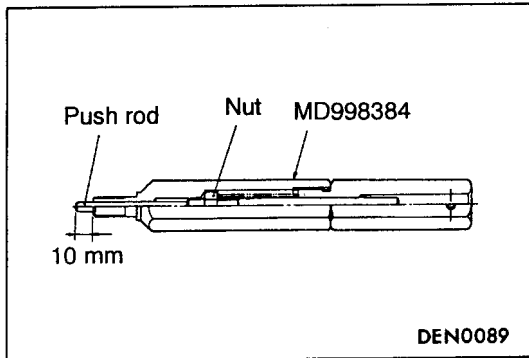


4. Align the timing marks of the camshaft sprocket and set the No. 1 cylinder to the top dead centre position.

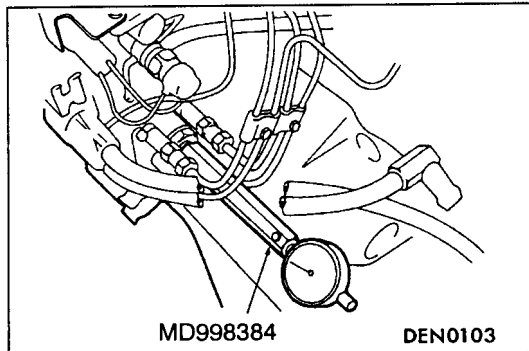


5. Remove the timing check plug at the rear of the injection pump.

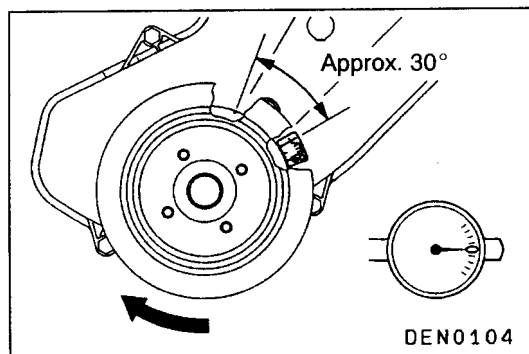




6. Before installation of special tool, make sure that push rod is protruding by 10 mm. Protrusion of push rod can be adjusted with an inner nut.
7. Connect the dial gauge to the special tool.



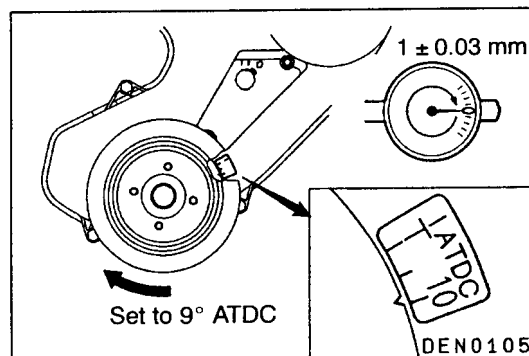
8. Install the special tool to the check plug at the rear of the injection pump.



9. Turn the crankshaft clockwise to move the No. 1 cylinder approximately 30° before compression top dead centre.
10. Set the needle of the dial gauge to 0.
11. Check that the needle doesn't move even if the crankshaft is turned slightly (2 - 3°) in both clockwise and counterclockwise direction.

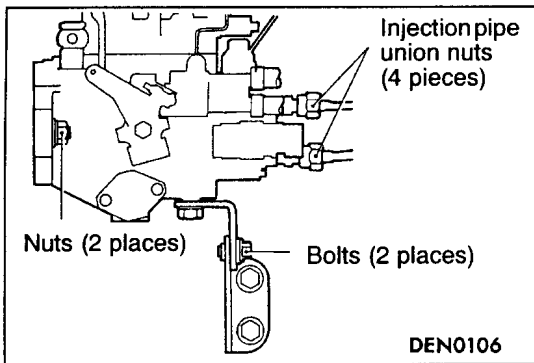
NOTE

If the needle moves, the notch is not positioned properly, so once again move the No. 1 cylinder approximately 30° before compression top dead centre.



12. Turn the crankshaft clockwise to align the No. 1 cylinder to 9° ATDC.
13. Check that the value indicated on the dial gauge is at the standard value.

Standard value: 1 ± 0.03 mm



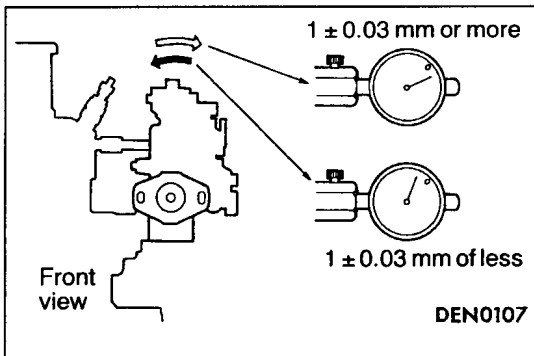
14. If the needle is outside the standard value, adjust the injection timing by the following procedure.

- (1) Loosen the injection pipe union nuts (4 places) on the injection pump. (Do not remove the union nuts.)

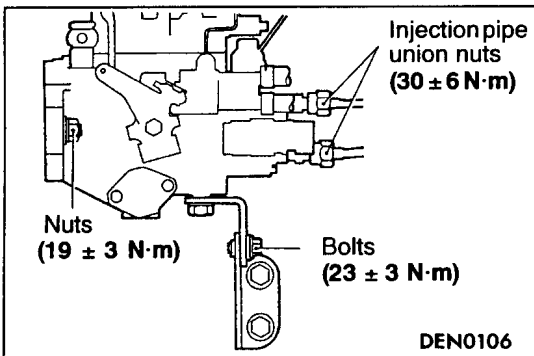
Caution

When loosening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

- (2) Loosen the upper mounting nuts and the lower mounting bolts of the injection pump. (Do not remove the nut and bolt.)



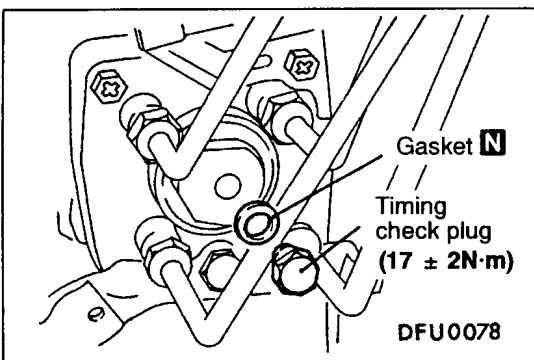
- (3) Tilt the injection pump to the left and right and adjust the needle on the dial gauge so that the display value is uniform.
- (4) Provisionally tighten the mounting nut and bolt of the injection pump.
- (5) Repeat steps 9 – 13 to check if the adjustment has been made correctly.



- (6) Tighten the mounting nuts and bolts to the specified torque.
- (7) Tighten the injection pump union nuts to the specified torque.

Caution

When tightening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

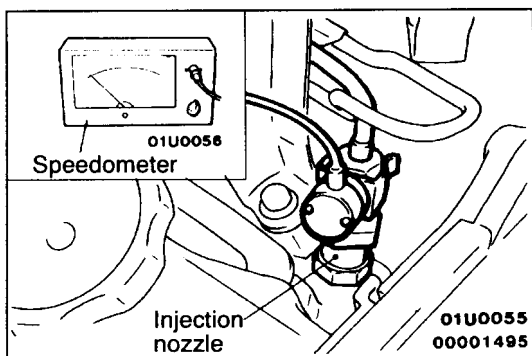


15. Remove the special tool.
16. Install a new gasket to the timing check plug.
17. Tighten the timing check plug to the specified torque.

IDLE SPEED CHECK AND ADJUSTMENT**NOTE**

Check that the injection timing is normal

1. Before inspection, set the vehicle to the pre-inspection condition.



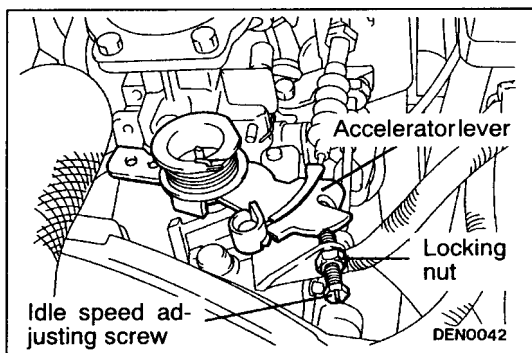
2. Connect the speedometer to the injection nozzle or the injection pipe.

Caution

When the speedometer is connected to the injection pipe, the pipe mounting clamps should all be removed.

3. Start the engine and run it at idle.
4. Check the idle speed.

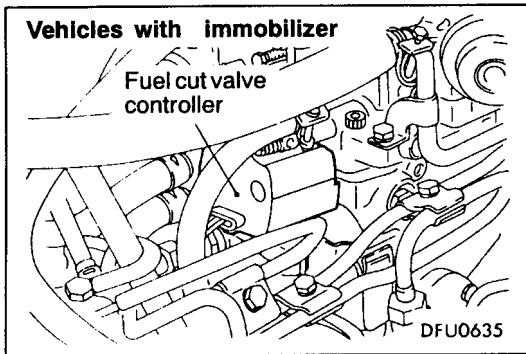
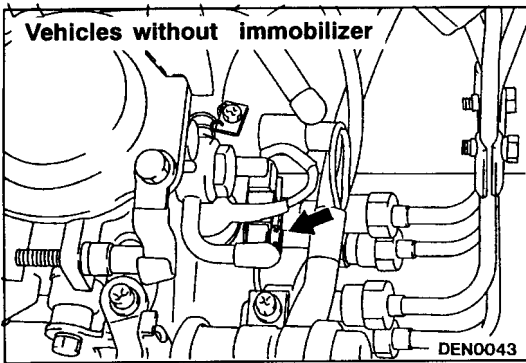
Standard value: 750 ± 100 r/min



5. If not within the standard value, loosen idle adjusting screw lock nut and adjust the idle speed by rotating adjusting screw. And tighten locking nut.

IDLE-UP MECHANISM CHECK AND ADJUSTMENT-FOR A/C

Refer to GROUP 55 – On-vehicle Service.



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 glow plugs.

3. Disconnect the fuel cut solenoid valve connector.
<Vehicles without immobilizer> Disconnect the fuel cut valve controller connector. <Vehicles with immobilizer>

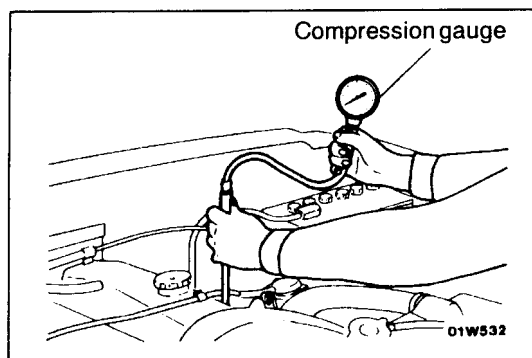
NOTE

Doing this will prevent carrying out fuel injection.

4. Cover the glow 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 glow 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 glow plug hole, which is dangerous.



5. Set compression gauge to one of the glow plug holes.
6. Crank the engine and measure the compression pressure.

Standard value (at engine speed of 280 r/min):
3,040 kPa

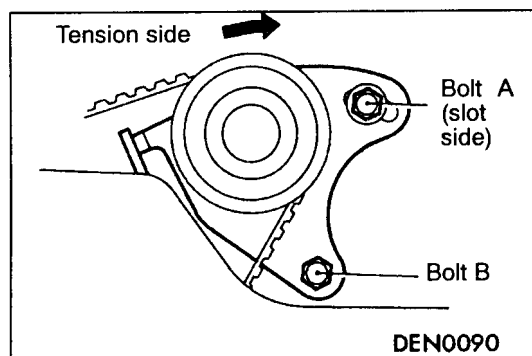
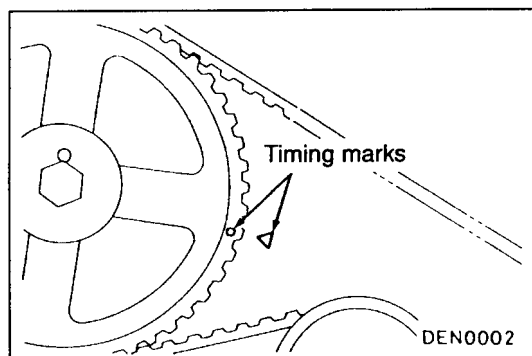
Limit (at engine speed of 280 r/min): min. 2,256 kPa

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

Limit: max 294 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 glow 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 fuel cut solenoid valve connector or fuel cut valve controller connector.
10. Install the glow plugs.

Tightening torque: 18 ± 2 N·m



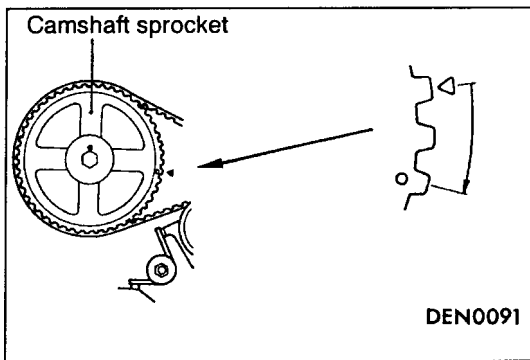
TIMING BELT TENSION ADJUSTMENT

1. Remove the timing belt upper cover.
2. Align the timing mark on the camshaft sprocket with the timing mark on the front upper case to set the No.1 cylinder to top dead centre of its compression stroke.

3. Loosen the two tensioner mounting bolts 1 or 2 turns.

NOTE

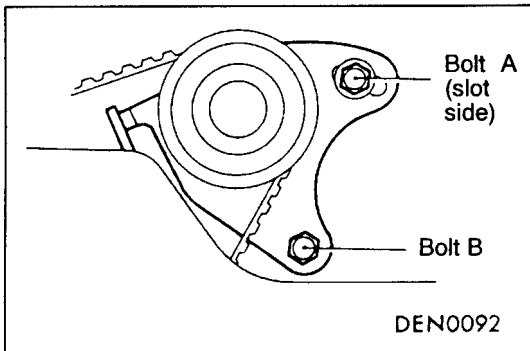
This will allow the tensioner spring to tension the timing belt automatically.



4. Turn the crankshaft clockwise and stop at the second teeth of the camshaft sprocket.

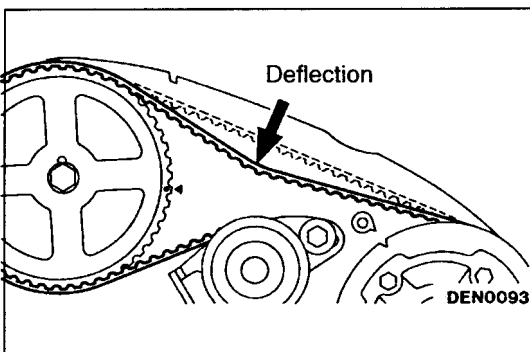
Caution

- (1) This will allow the timing belt to be tensioned by a specified amount, so never overturn the crankshaft.
- (2) Never turn the crankshaft counterclockwise.



5. To prevent the tensioner bracket from be turned together with the crankshaft, first tighten slot-side bolt A to the specified torque, and then tighten bolt B to the specified torque.

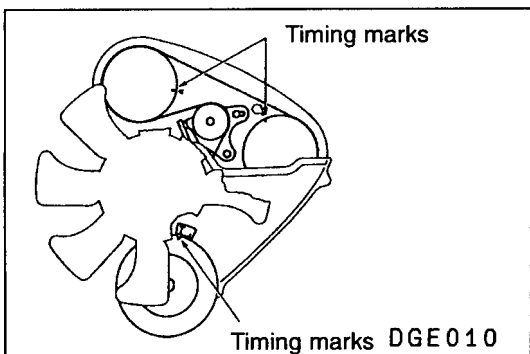
Tightening torque: 26 N·m



6. Turn the crankshaft counterclockwise to align the timing marks. Push down belt at a point halfway with a forefinger to check that deflection of belt is up to standard value.

Standard value: 4.0 – 5.0 mm

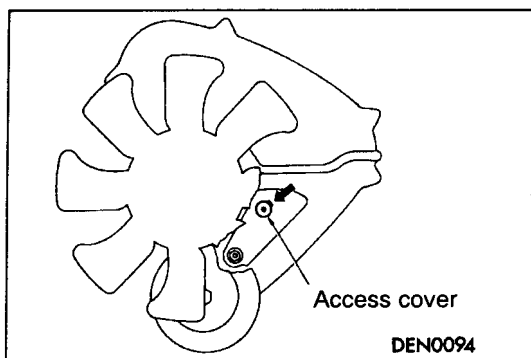
7. Mount the timing belt upper cover.

**TIMING BELT B TENSION ADJUSTMENT**

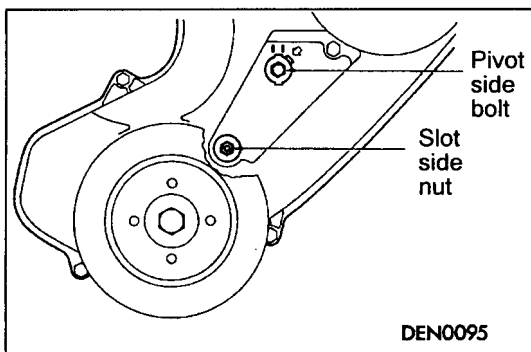
1. Remove timing belt upper cover.
2. Turn the crankshaft in the clockwise direction and check the timing belt around its entire circumference for abnormalities.
3. Align the timing marks on the sprockets with the timing mark on the front upper case.

Caution

When aligning the timing mark, be sure not to turn the crankshaft in the counterclockwise direction as this can cause improper belt tension.



4. Remove the access cover.



5. Loosen the tensioner pivot side bolt 1 mm and slot side nut 1 or 2 turns.

NOTE

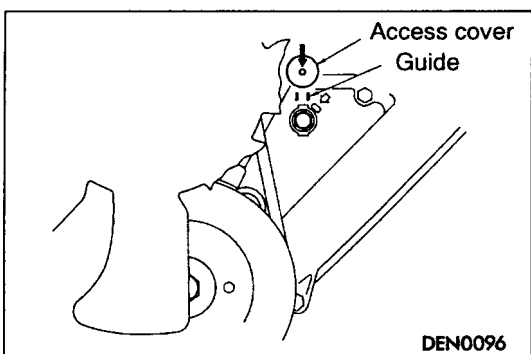
These works will allow the tensioner spring to tension timing belt B automatically.

6. First tighten tensioner slot side nut, and then tighten pivot side bolt to the specified torque.

Tightening torque:

Pivot side bolt 24 ± 4 N·m

Slot side nut 23 ± 3 N·m



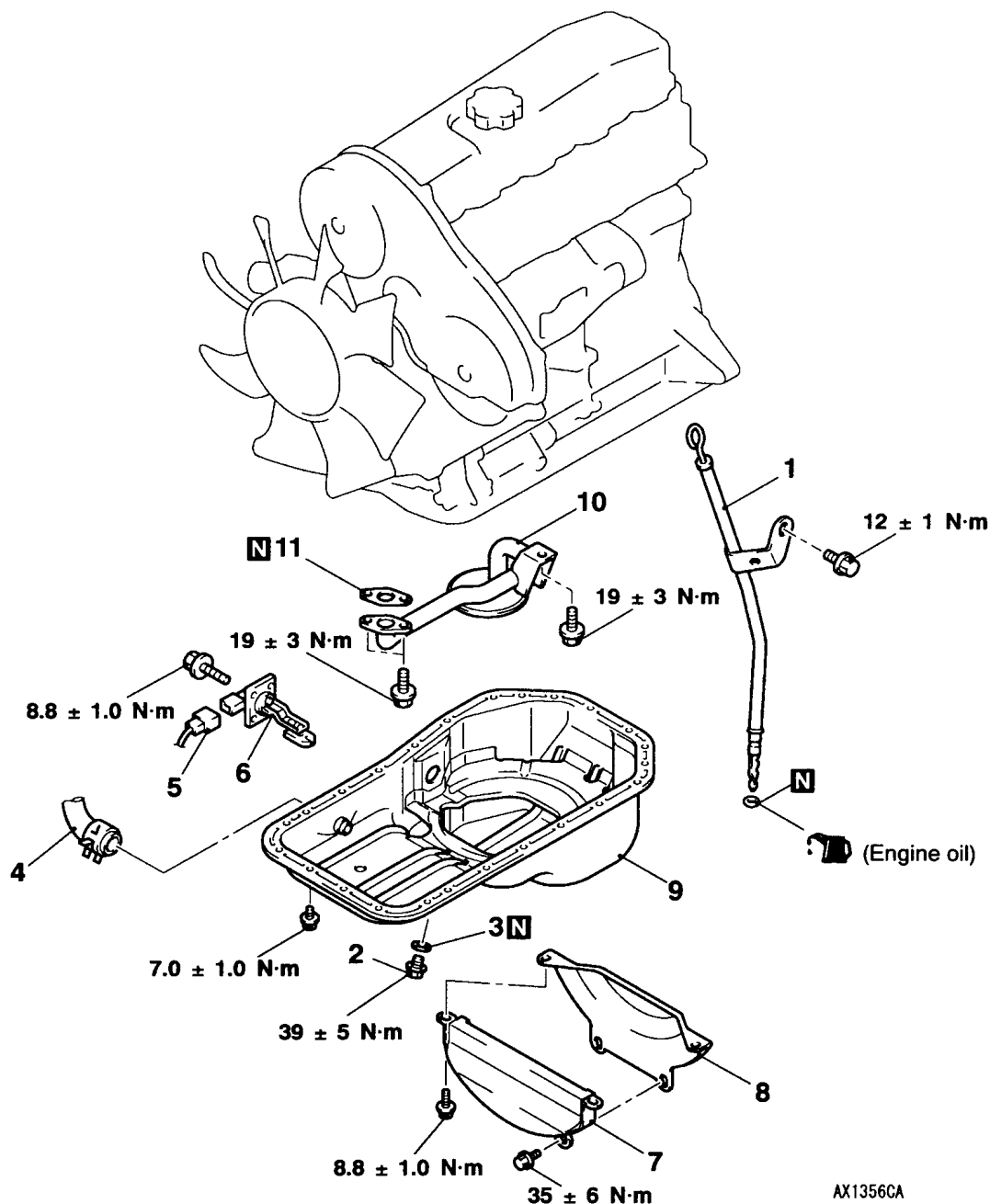
7. Install the access cover while sliding the front lower cover down along the two guides.
8. Install the timing belt upper cover.

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 Supplying
(Refer to GROUP 12 – On-vehicle Service.)
- Differential Gear Oil Draining and Supplying
(Refer to GROUP 26 – On-vehicle Service.)
- Front Differential and No.2 Crossmember Assembly Removal and Installation
(Refer to GROUP 11A – Oil Pan and Oil Screen.)



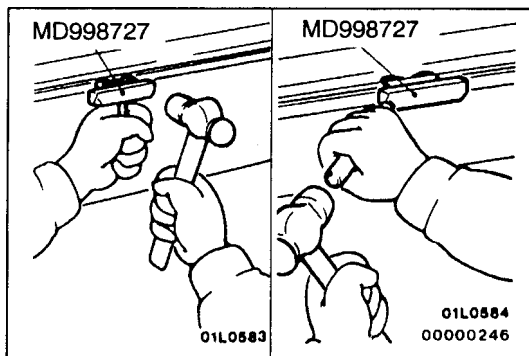
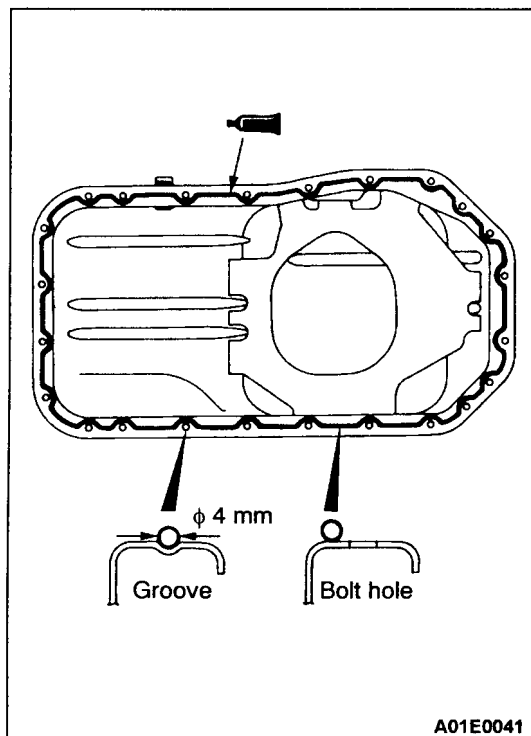
AX1356CA

Removal steps

1. Engine oil level gauge and guide assembly
2. Drain plug
3. Drain plug gasket
4. Alternator vacuum pump oil return hose connection
5. Oil level sensor connector

6. Oil level sensor
7. Space rubber
8. Bell housing cover
9. Oil pan
10. Oil screen
11. Oil screen gasket



**REMOVAL SERVICE POINT****◀▶ OIL PAN REMOVAL****INSTALLATION SERVICE POINTS****▶▶ OIL PAN INSTALLATION**

1. Remove sealant from oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine mating surface.
3. Apply a continuous bead of the specified sealant to the oil pan mating surface as shown.

Specified sealant:

mitsubishi GENUINE PART No. MD970389 or equivalent

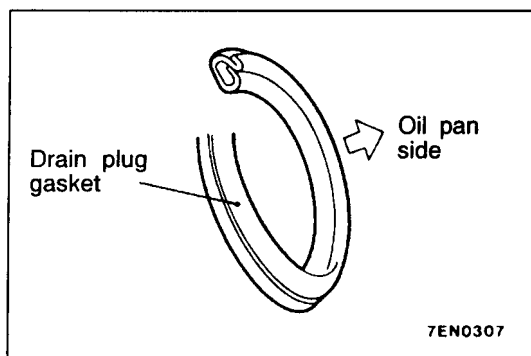
NOTE

The sealant should be applied in a continuous bead approximately 4 mm in diameter.

4. Assemble oil pan to cylinder block within 15 minutes after applying the sealant.

Caution

After installing the oil pan, wait at least 1 hour before starting the engine.

**▶▶ DRAIN PLUG GASKET INSTALLATION**

Install a new gasket in the direction so that it faces as shown in the illustration.

INSPECTION

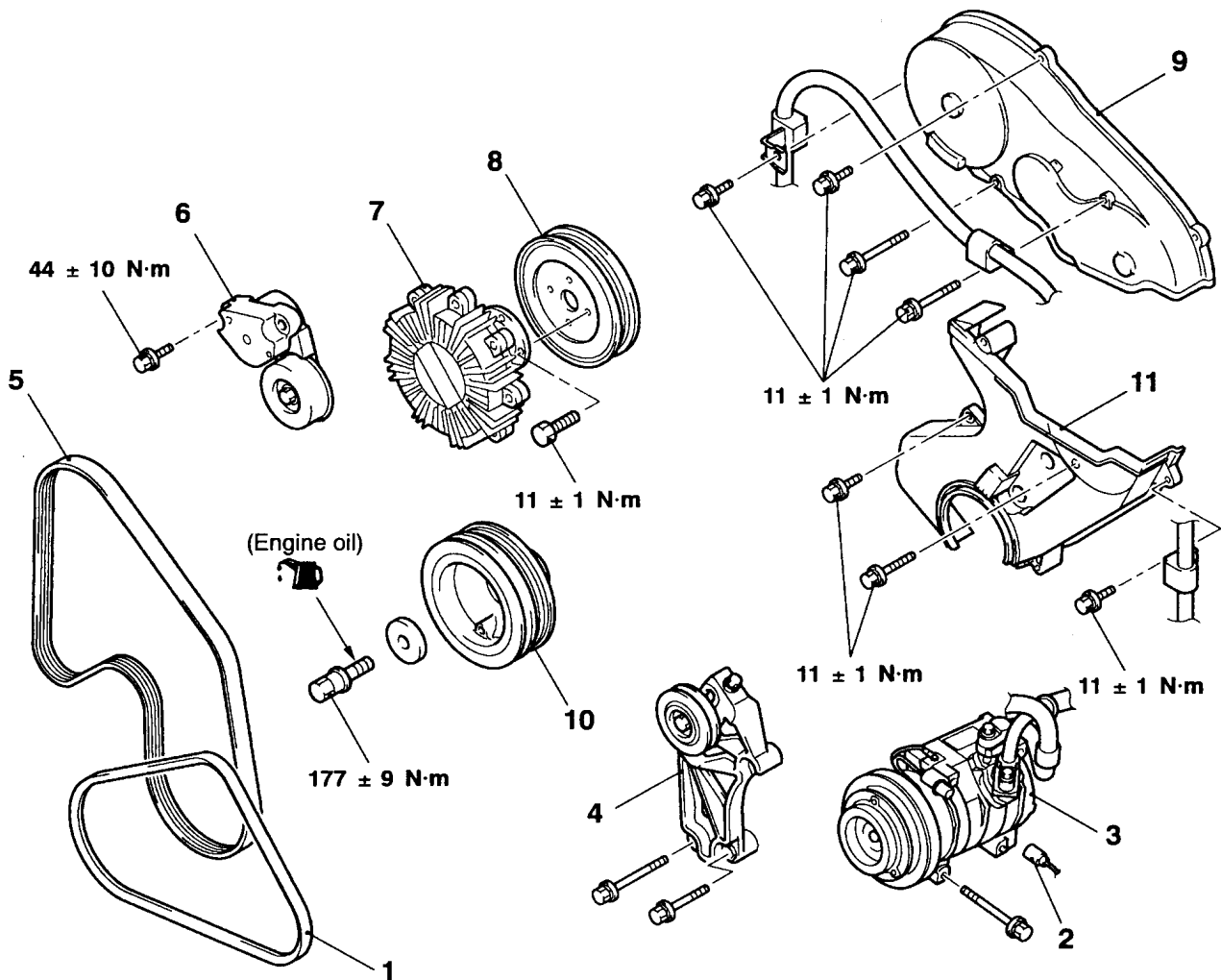
- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.

TIMING BELT AND TIMING BELT B

REMOVAL AND INSTALLATION

Post-installation Operation

Drive Belt Tension Check and Adjustment
(Refer to P.11B-5.)



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Removal steps

- Radiator upper shroud
(Refer to GROUP 14.)
- 1. A/C compressor drive belt
<Vehicles with A/C>
- 2. A/C compressor connector
<Vehicles with A/C>
- 3. A/C compressor <Vehicles with A/C>
- 4. Tension pulley and tension pulley
bracket assembly <Vehicles with A/C>

- Cooling fan (Refer to GROUP 14.)
- 5. Alternator and power steering oil
pump drive belt
- 6. Auto-tensioner
- 7. Fan Clutch
- 8. Water pump pulley
- 9. Timing belt front upper cover
- 10. Crankshaft pulley
- 11. Timing belt front lower cover

◀A▶

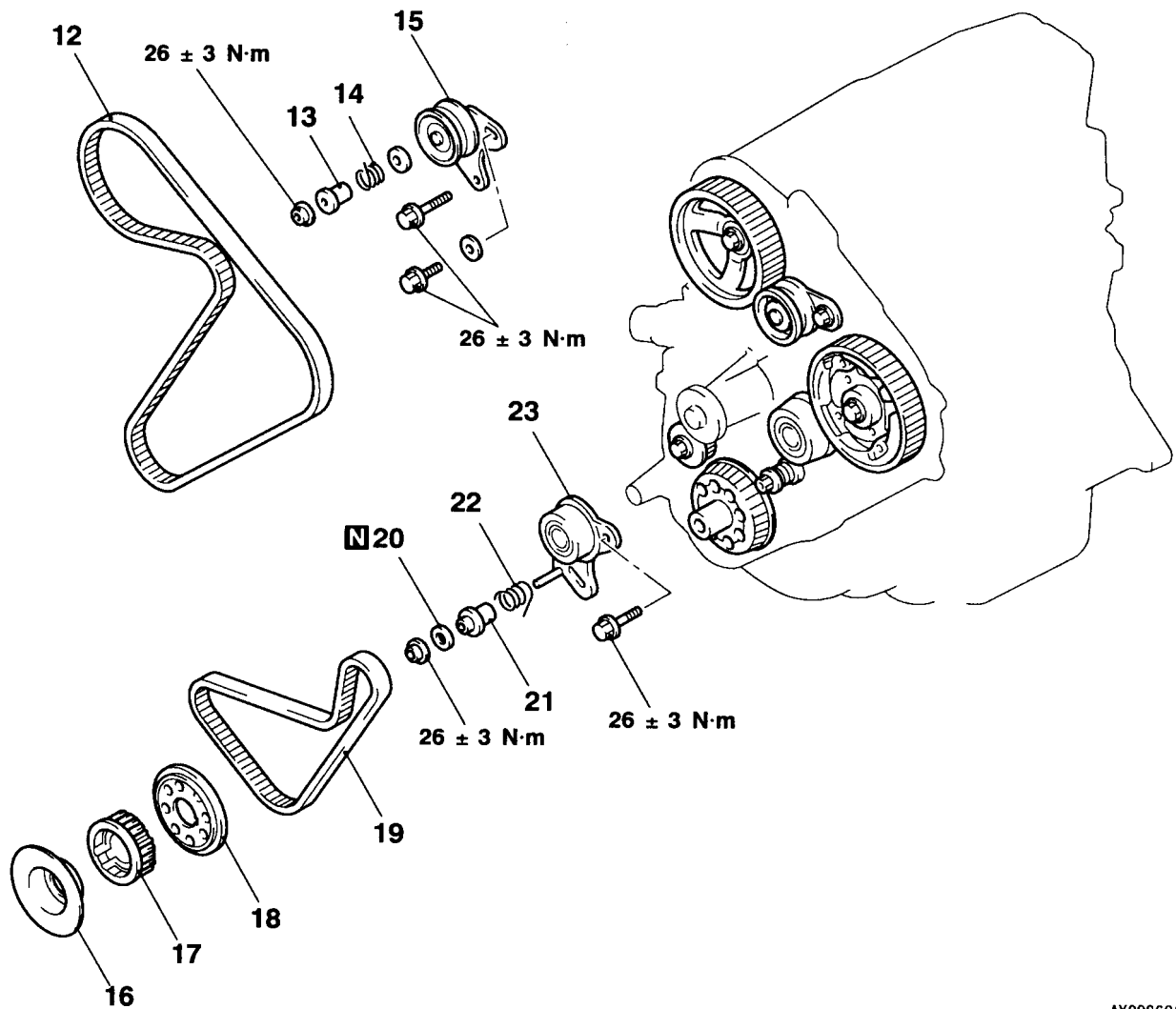
◀C▶

◀B▶

◀D▶

▶C▶

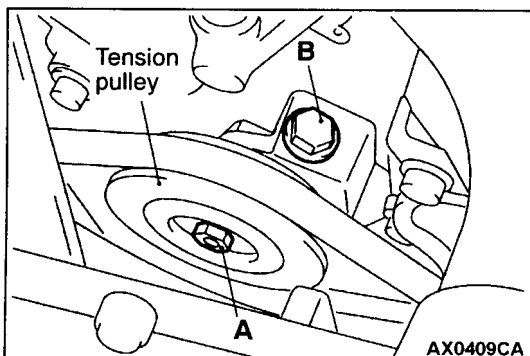
▶C▶



AY0086CA

- ◀E▶ ▶B▶
- 12. Timing belt
 - 13. Tensioner spacer
 - 14. Tensioner spring
 - 15. Timing belt tensioner
 - 16. Front flange
 - 17. Crankshaft sprocket

- ◀F▶ ▶A▶
- 18. Flange
 - 19. Timing belt B
 - 20. Gasket
 - 21. Tensioner spacer B
 - 22. Tensioner spring B
 - 23. Timing belt tensioner B



REMOVAL SERVICE POINTS

◀A▶ A/C COMPRESSOR DRIVE BELT REMOVAL

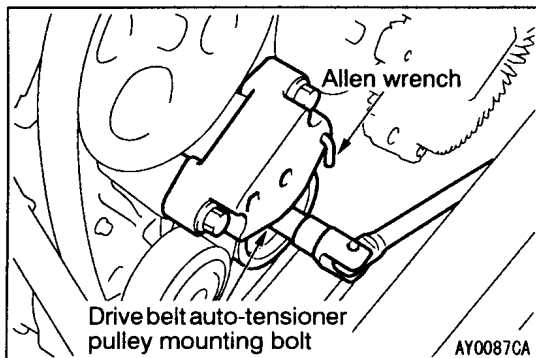
1. Loosen the tension pulley securing bolt A.
2. Loosen the adjusting bolt B to remove the belt.

Caution

To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

◀B▶ A/C COMPRESSOR REMOVAL

1. Remove the A/C compressor from the bracket with its refrigerant hoses still attached.
2. Suspend the A/C compressor with a cord out of the way.

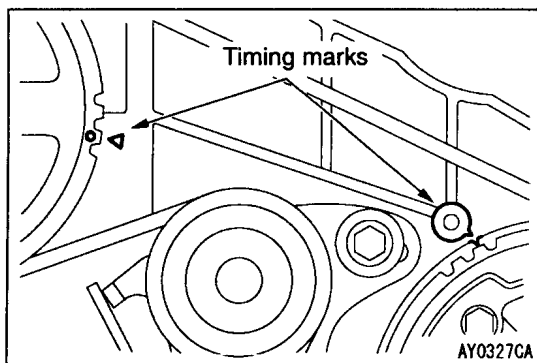
**◀C▶ ALTERNATOR AND POWER STEERING PUMP DRIVE BELT REMOVAL**

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

1. Locate a ring spanner onto the drive belt auto-tensioner pulley mounting bolt, and move the tensioner clockwise until it touches the stopper.
2. Hold the tensioner by inserting an Allen wrench as shown, and remove the drive belt.

Caution

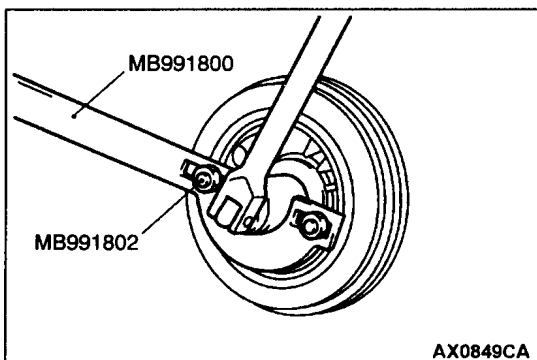
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

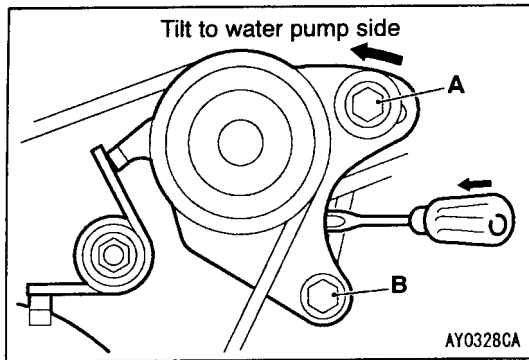
**◀D▶ CRANKSHAFT PULLEY REMOVAL**

1. Turn the crankshaft clockwise, align the timing marks to set No.1 cylinder to TDC of its compression stroke.

Caution

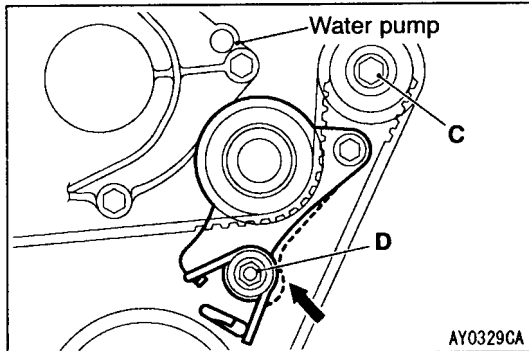
Never turn the crankshaft anticlockwise.





◀E▶ TIMING BELT REMOVAL

1. When reinstalling timing belt, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt A and B.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt A and B. Secure so that tensioner will not move back.



◀F▶ TIMING BELT B REMOVAL

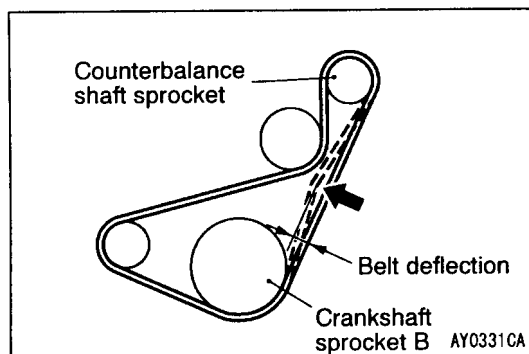
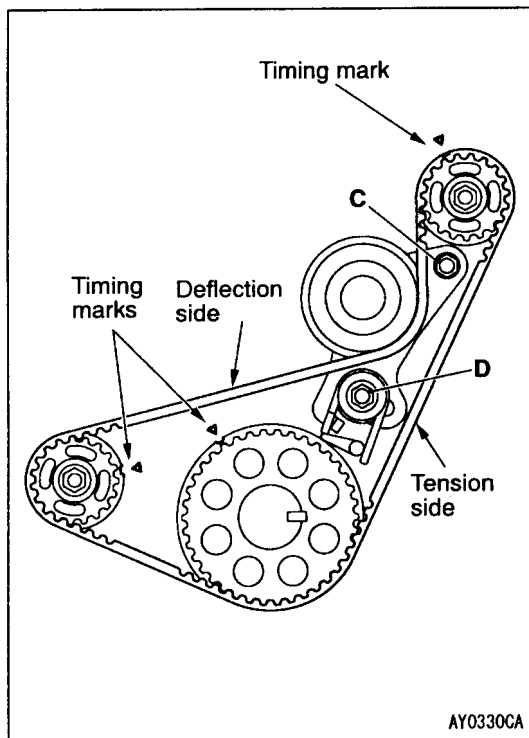
1. When reinstalling timing belt B, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt C and nut D.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt C and nut D. Secure so that tensioner will not move back.

INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT B INSTALLATION

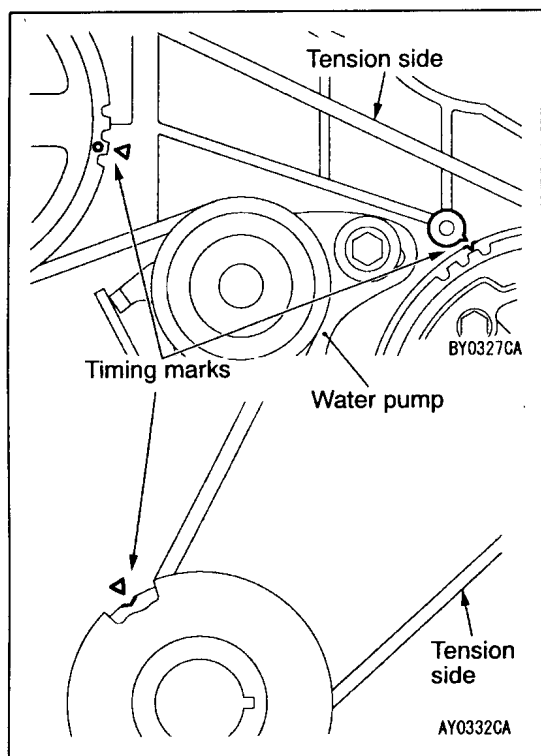
1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt B, make sure the arrow mark is pointing in the same direction as when the belt was removed.
3. Install timing belt B and make sure there is no deflection on the tension side.
4. Press the deflection side of timing belt B with the hand and fully stretch the tensioner side.
5. Make sure that the timing marks are aligned.
6. Loosen the tensioner mounting bolt and nut so that only the pressure of the spring is applied to timing belt B.
7. Tighten the tensioner mounting bolt C and nut D, tightening the nut first. If the bolt is tightened first, the tensioner will move and tension the belt.

Tightening torque: 26 ± 3 N·m



8. Press in the direction of the arrow in the figure with the index finger to check the amount of deflection.

Standard value: 4 - 5 mm

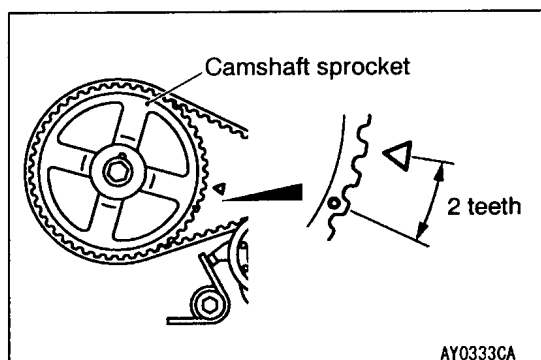


►B◄ TIMING BELT INSTALLATION

1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt, make sure the arrow mark is pointing in the same direction as when the belt was removed.
3. Install the timing belt to the crankshaft sprocket, to injection pump sprocket, to tensioner and to camshaft sprocket in that order. Being careful not to allow deflection on the tension side of the timing belt.

Caution

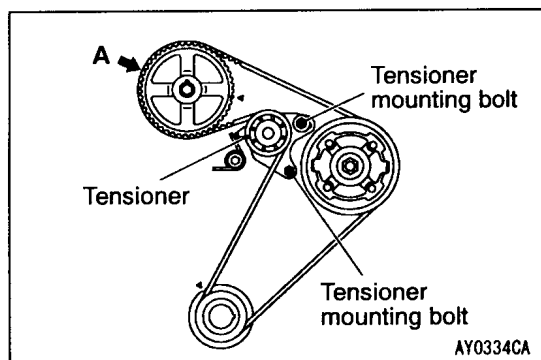
- (1) Engage the belt on the various sprockets while maintaining tension on the belt of tension side.
- (2) Align the injection pump sprocket with the timing mark, hold the sprocket so that it does not turn and engage the belt.
4. Loosen the tensioner mounting bolts and apply tension with the spring.

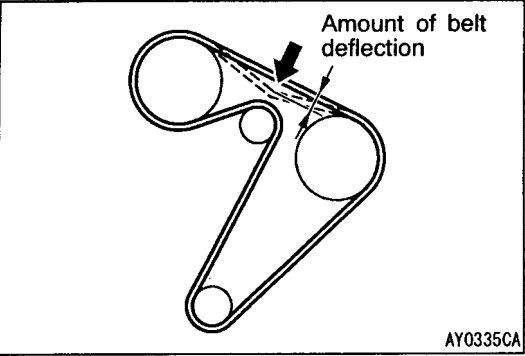


5. Turn the crankshaft clockwise and stop at the second lobe of the camshaft sprocket.

Caution

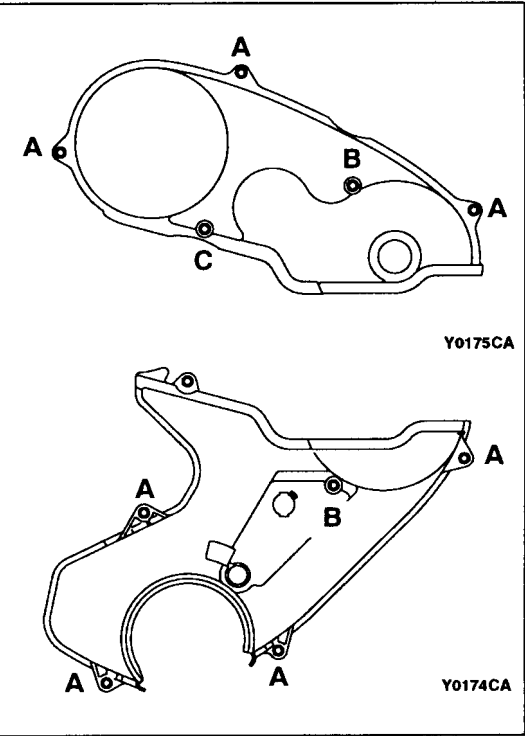
- (1) When turning the crankshaft in item (5), strictly observe the specified amount of rotation (2 teeth on the camshaft sprocket) in order to apply a constant force to the tension side of the belt.
- (2) Do not turn the crankshaft counterclockwise.
- (3) Do not touch the belt during adjustment.
6. Make sure that the part indicated by arrow A does not float upward.
7. Tighten the tensioner mounting bolts, starting with the bolt in the elongated hole. If the lower bolt is tightened first, belt tension will become too tight.
8. Turn the crankshaft anticlockwise and align the timing mark. Next, make sure that the timing marks of all sprockets are aligned.





9. Press on the center of the belt with an index finger to check the amount of deflection.

Standard value: 4 – 5 mm



►C◄ TIMING BELT FRONT LOWER COVER/TIMING BELT FRONT UPPER COVER INSTALLATION

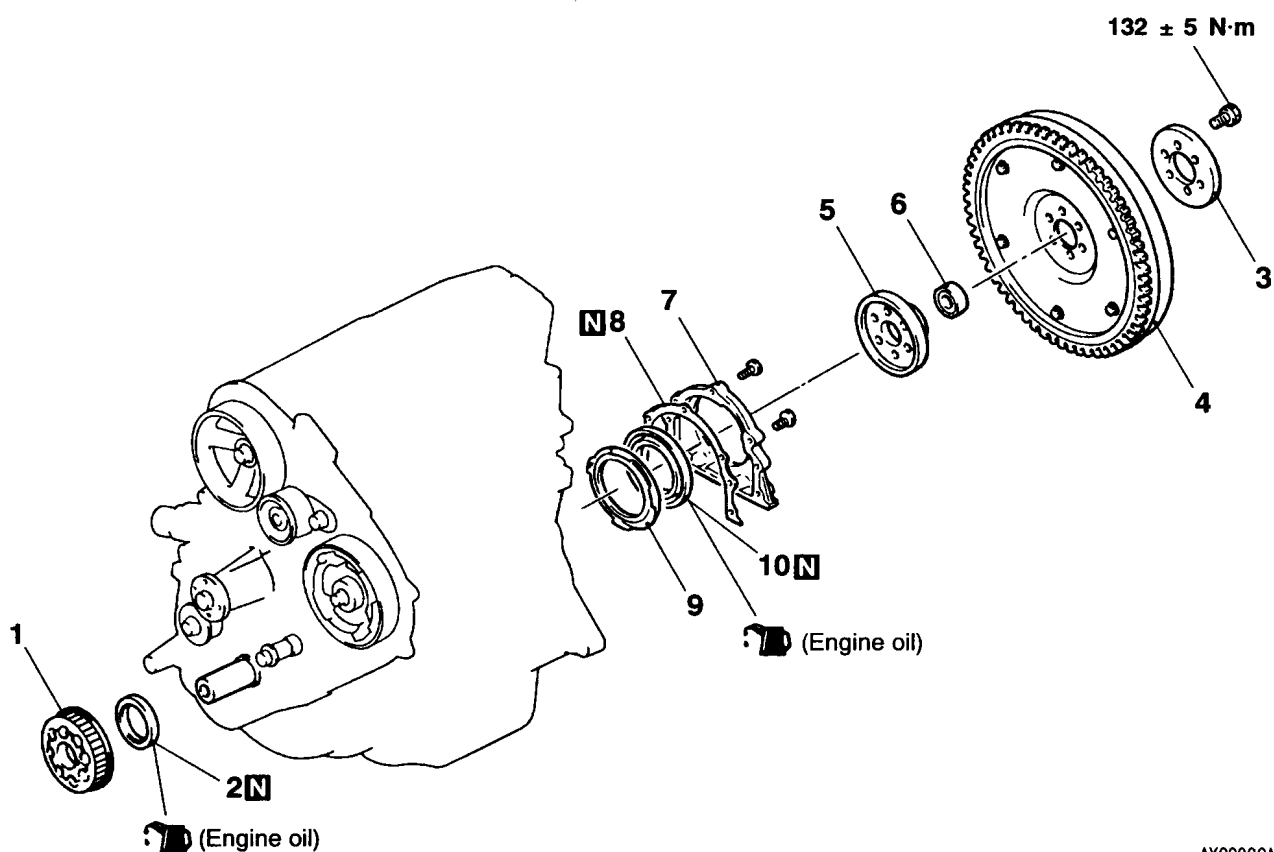
Install the bolts to the timing belt cover at the shown positions.

Name	Symbols	Size mm (d × l)
Flange bolt	A	6 × 22
	B	6 × 50
	C	6 × 60

d=Nominal diameter
l=Nominal length

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION



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Crankshaft front oil seal removal steps

- Timing belt and timing belt B removal and installation (Refer to P.11B-19.)

1. Crankshaft sprocket B
2. Crankshaft front oil seal



Crankshaft rear oil seal removal steps

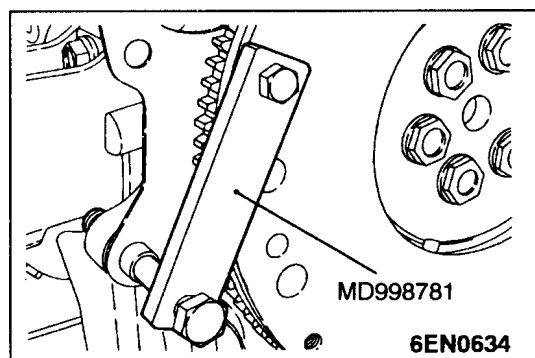
- Transmission assembly (Refer to GROUP 22.)

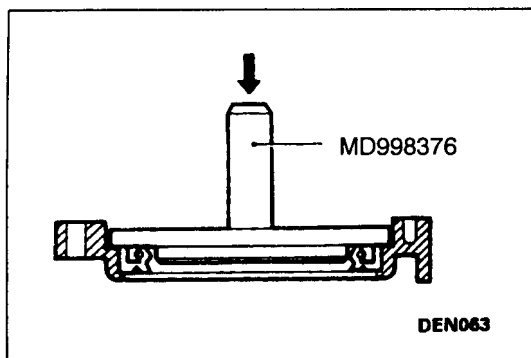
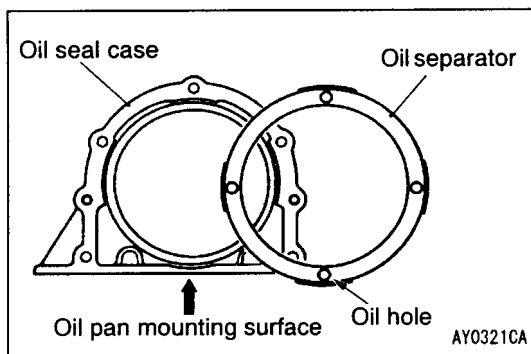
3. Adapter plate
4. Flywheel assembly
5. Crankshaft adaptor
6. Ball bearing
7. Oil seal case
8. Gasket
9. Oil separator
10. Crankshaft rear oil seal



REMOVAL SERVICE POINTS

◀A▶ FLYWHEEL ASSEMBLY REMOVAL



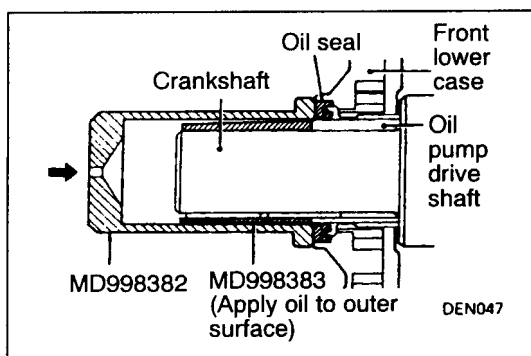
**INSTALLATION SERVICE POINTS****►A◄ CRANKSHAFT REAR OIL SEAL INSTALLATION****►B◄ OIL SEPARATOR INSTALLATION**

Install the oil separator in such a way that its oil hole come at the case bottom (indicated by an arrow in the illustration).

►C◄ FLYWHEEL ASSEMBLY INSTALLATION

Use the special tool in the same way as during removal to stop the flywheel assembly from turning, and then tighten the bolt to the specified torque.

Tightening torque: 132 ± 5 N·m

**►D◄ CRANKSHAFT FRONT OIL SEAL INSTALLATION**

Apply engine oil to the outside of the special tool (MD998383) and to the oil seal lip, and use the special tool to press-fit the oil seal.

CAMSHAFT AND CAMSHAFT OIL SEAL

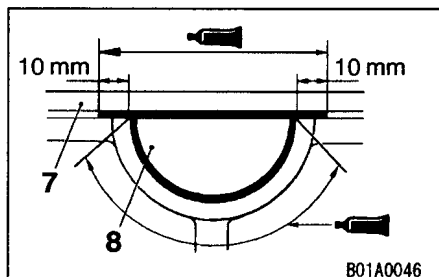
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

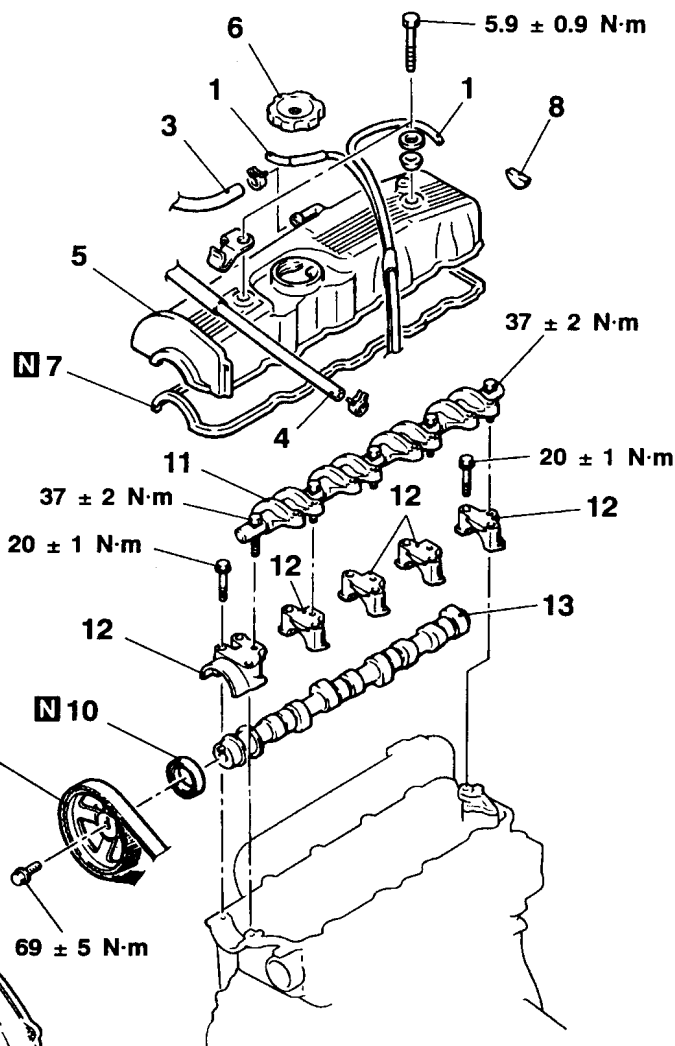
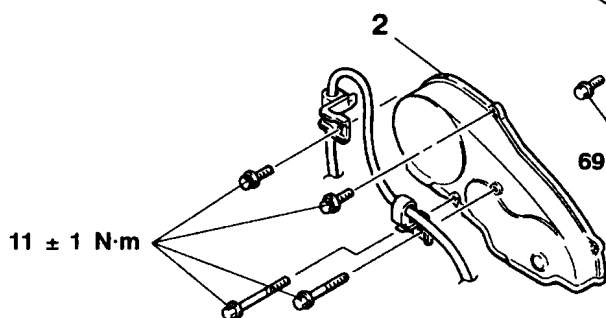
- Air Pipe and Air Intake Hose Removal and Installation (Refer to GROUP 15 – Intake Manifold and Exhaust manifold, Turbocharger <4D5>.)



Apply engine oil to all moving parts during installation.

**Sealant:**

3M ATD Part No. 8660 or
equivalent



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Camshaft removal steps

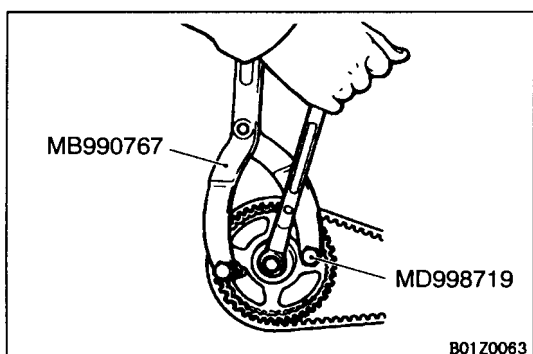
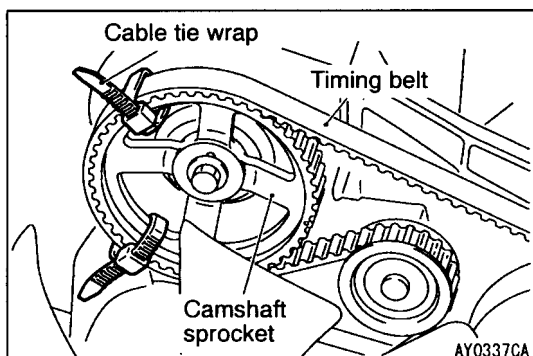
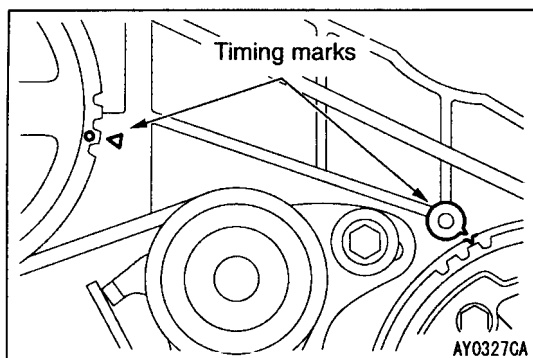
1. Vacuum hose connection
2. Timing belt front upper cover
3. Breather hose connection
4. Boost hose connection
5. Rocker cover
6. Oil filler cap
7. Rocker cover gasket
8. Semi-circular packing
- Valve clearance adjustment
(Refer to P.11B-8.)



9. Camshaft sprocket
10. Camshaft oil seal
11. Rocker arm and shaft assembly
12. Camshaft bearing cap
13. Camshaft

Camshaft oil seal removal steps

2. Timing belt upper cover assembly
9. Camshaft sprocket
10. Camshaft oil seal



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

1. Turn the crankshaft clockwise, align the timing marks to set No.1 cylinder to TDC of its compression stroke.

Caution

Never turn the crankshaft anticlockwise.

2. Tie the camshaft sprocket and timing belt together with a cable tie wrap so that timing mark is not maladjusted.

3. Use the special tool to stop the camshaft sprocket from turning, and then remove the camshaft sprocket with the timing belt still attached.

Caution

Do not rotate crankshaft after removing camshaft sprocket.

◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

Loosen the rocker arm and shaft assembly mounting bolt, and then remove the rocker arm and shaft assembly with the bolt still attached.

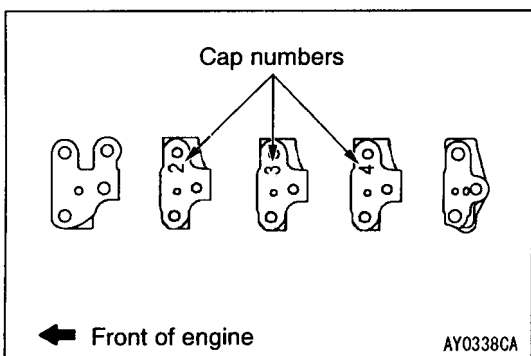
Caution

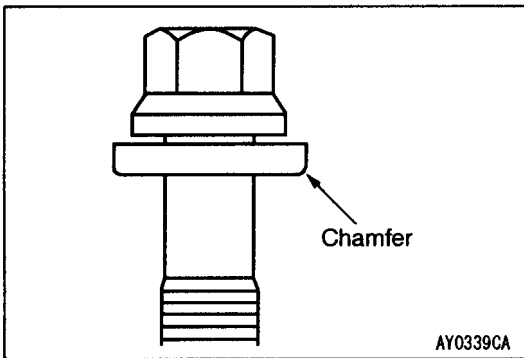
Never disassemble the rocker arm and shaft assembly.

INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT BEARING CAP INSTALLATION

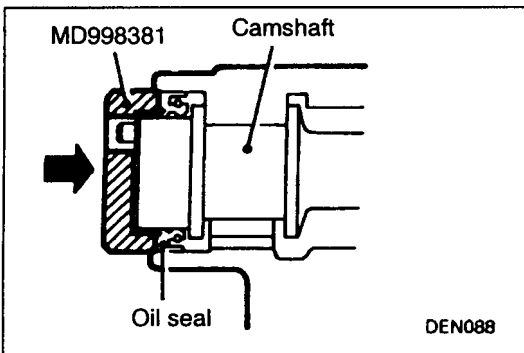
The cap numbers are embossed on the top surface of the bearing caps, so install in the order of the numbers. However, no numbers are embossed on bearing caps 1 and 5.





►B◄ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. Install the rocker arm and shaft assembly to the bearing caps.
2. Set the washer so that it faces in the direction shown in the illustration, and then install the bolt.



►C◄ CAMSHAFT OIL SEAL INSTALLATION

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

NOTE

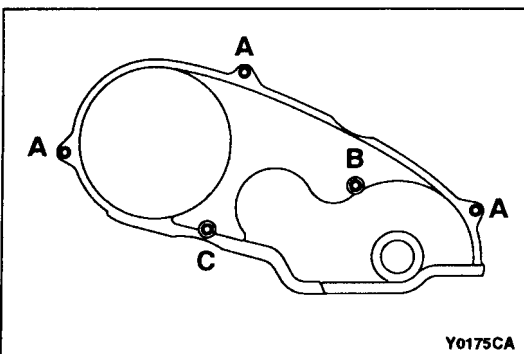
The oil seal should be tapped in until the distance from the end of the camshaft to the end of the oil seal is as shown in the illustration.

►D◄ CAMSHAFT SPROCKET INSTALLATION

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

Tightening torque: 69 ± 5 N·m

2. Remove the cord which binds the camshaft sprocket and timing belt.



►E◄ TIMING BELT FRONT UPPER COVER INSTALLATION

Install the bolts to the timing timing belt front upper cover at the shown positions.

Name	Symbols	Size mm (d × l)
Flange bolt	A	6 × 22
	B	6 × 50
	C	6 × 60

d=Nominal diameter

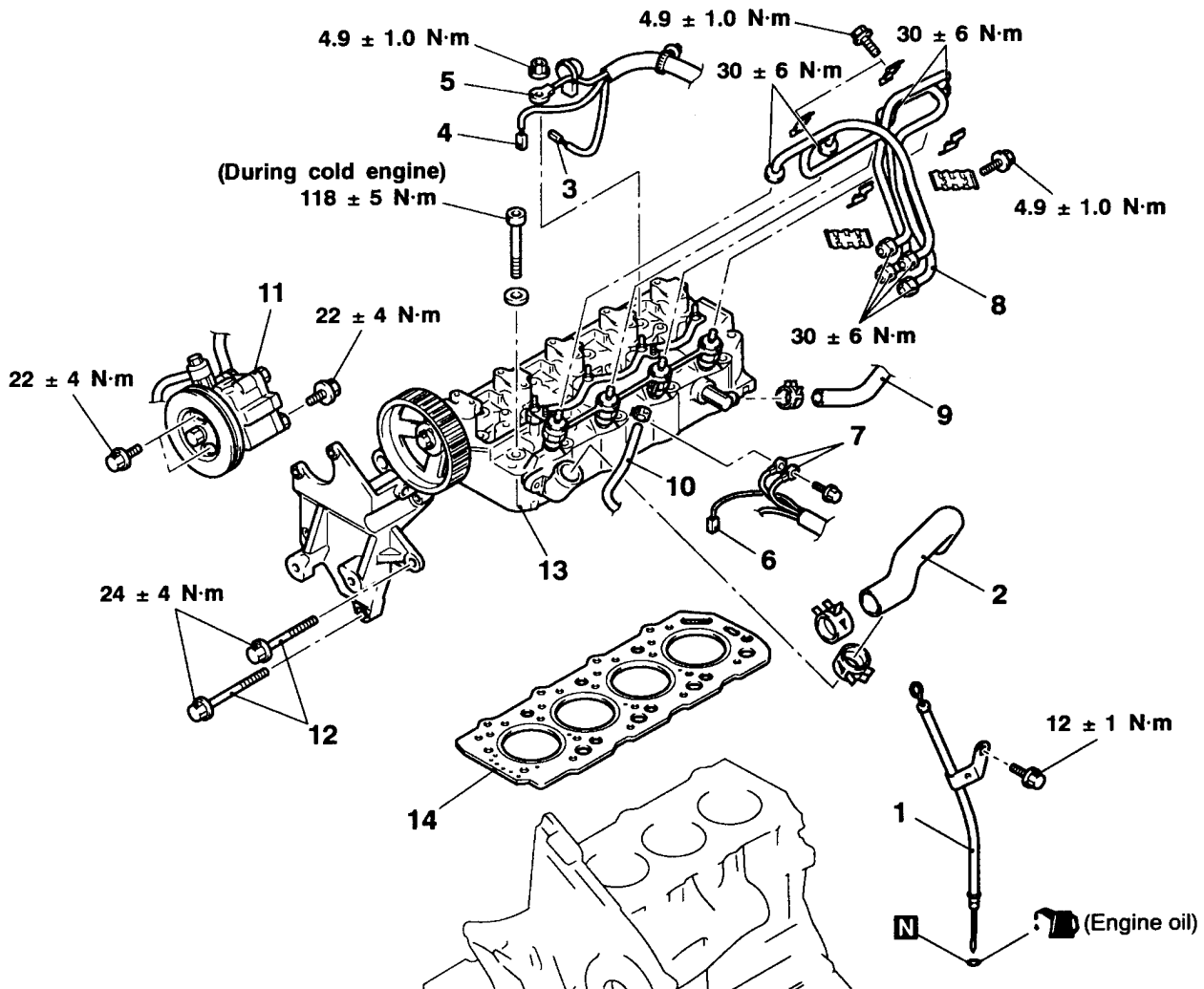
l=Nominal length

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 – Intake Manifold and Exhaust Manifold, Turbocharger <4D5>.)
- Engine Oil Check and Refill (Refer to GROUP 12 – On-vehicle Service.) <Post-installation operation>
- Fuel Line Air-bleeding (Refer to GROUP 13B – On-vehicle Service.) <Post-installation operation>
- Timing Belt Removal and Installation (Refer to P.11B-19.)



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Removal steps

- | | |
|--|--|
| <p>◀A▶ ▶D▶</p> <ol style="list-style-type: none"> Oil level gauge guide and oil level gauge assembly Radiator upper hose Engine coolant temperature switch connector (for A/C compressor control.) Engine coolant temperature switch connector (for condenser fan control.) Glow plug connector Engine coolant temperature gauge unit and sensor connector | <p>◀B▶ ▶C▶</p> <p>◀C▶</p> <p>◀D▶ ▶B▶ ▶A▶</p> <ol style="list-style-type: none"> Earth cable connection Fuel injection pipe Heater hose connection Fuel hose connection Water pipe assembly C (Refer to GROUP 14.) Power steering oil pump assembly Power steering oil pump bracket bolt Cylinder head assembly Cylinder head gasket |
|--|--|

REMOVAL SERVICE POINTS**◀A▶ RADIATOR UPPER HOSE DISCONNECTION**

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

◀B▶ FUEL INJECTION PIPE REMOVAL

When loosening nuts at both ends of injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with wrench and loosen nut.

Caution

After disconnecting the injection pipe, plug the opening so that no foreign particles get inside the pump or into the injection nozzle.

◀C▶ POWER STEERING OIL PUMP REMOVAL

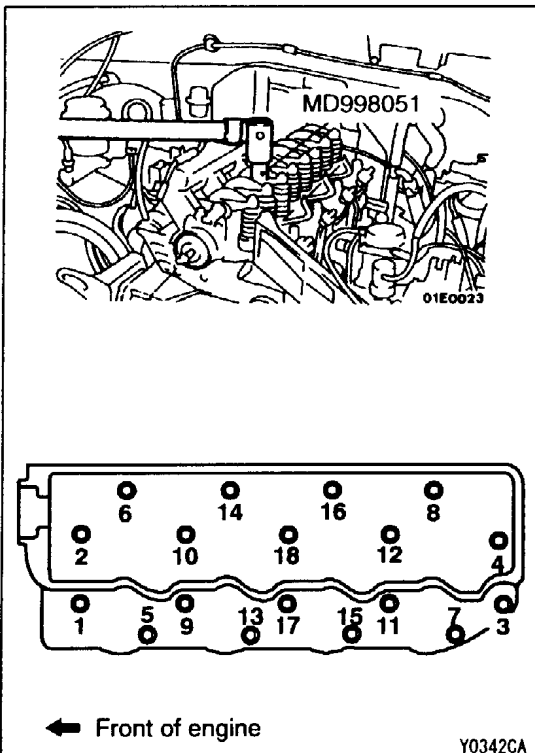
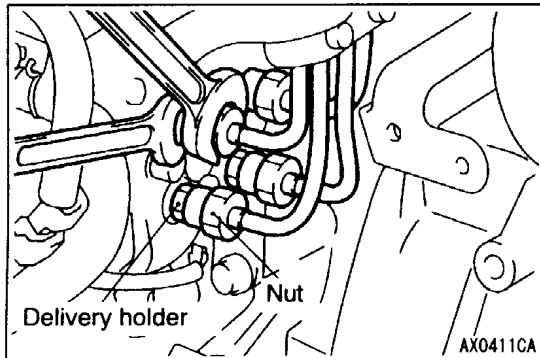
Remove the power steering oil pump from the bracket with the hose attached.

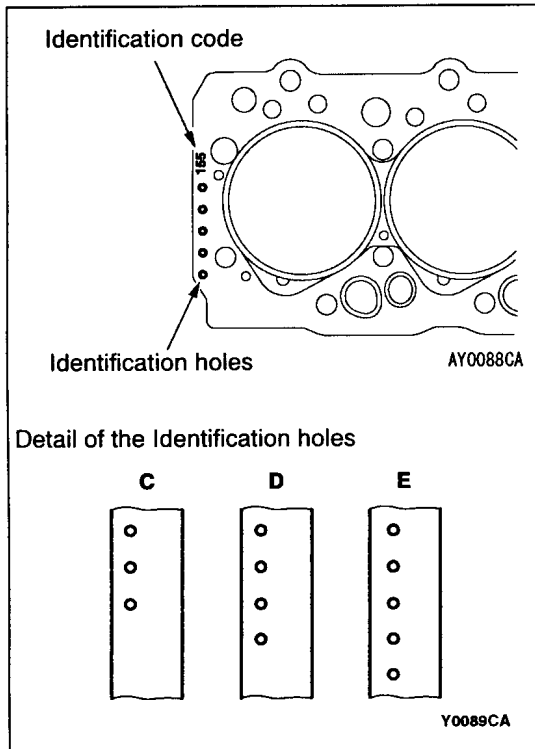
NOTE

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.

◀D▶ CYLINDER HEAD ASSEMBLY REMOVAL

Use the special tool to loosen the cylinder head bolts in the shown sequence progressively, and then remove the cylinder head bolts.





INSTALLATION SERVICE POINTS

►A◀ CYLINDER HEAD GASKET INSTALLATION

To replace the cylinder head gasket only, select a gasket of correct specification according to the table below.

Identification holes specification	Identification code specification	Part number
C (Thickness after tightening the bolts 1.45 mm)	145	MD302891
D (Thickness after tightening the bolts 1.50 mm)	150	MD302892
E (Thickness after tightening the bolts 1.55 mm)	155	MD302893

Caution

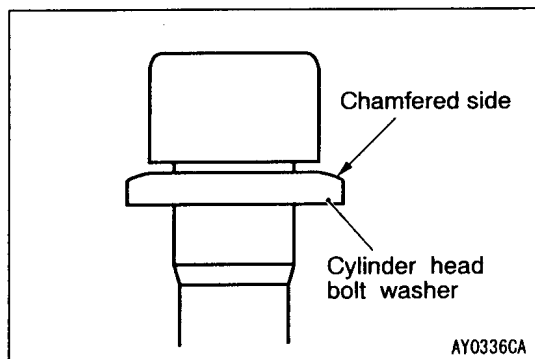
The thickness of the original cylinder head gasket is selected according to the protrusion amount of the piston. Therefore, if the piston or the connecting rod is replaced, the protrusion amount may be changed. Always select a correct gasket by measuring the protrusion amount. (For details, refer to the Engine Workshop Manual.)

►B◀ CYLINDER HEAD INSTALLATION

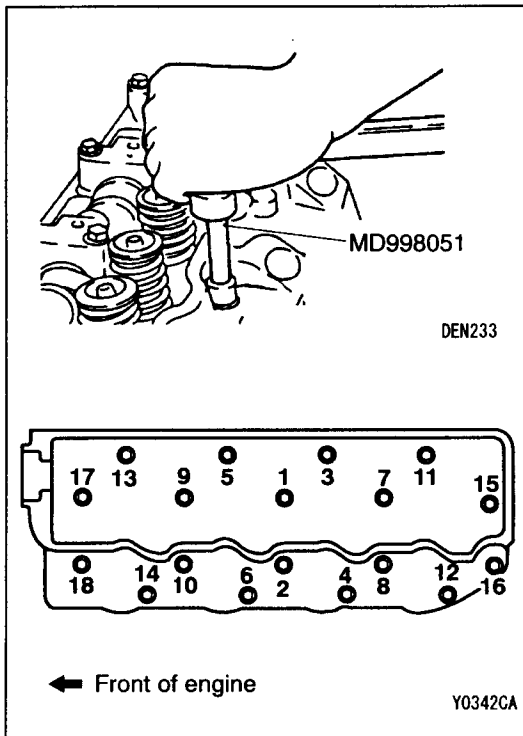
1. Select a cylinder head gasket of correct specification.
2. Clean the cylinder head assembly and the cylinder block mating surfaces with a scraper or a wire brush.

Caution

Do not allow foreign material to enter the engine coolant or oil passages and the cylinder.



3. Install the cylinder head bolt washer to the cylinder head bolt so that the washer chamfered side faces as shown.



4. Use the special tool to tighten the cylinder head bolts in the shown sequence progressively, and then install the cylinder head bolts.

Tightening torque : 132 ± 5 N·m (During cold engine)

►C◄ RADIATOR UPPER HOSE CONNECTION

To reuse the radiator upper hose, align the mating marks that were made during removal, and then install the hose clamp.

►D◄ FUEL INJECTION PIPE INSTALLATION

When tightening the nuts at both ends of the fuel injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with a wrench, and tighten the nuts to the specified torque.

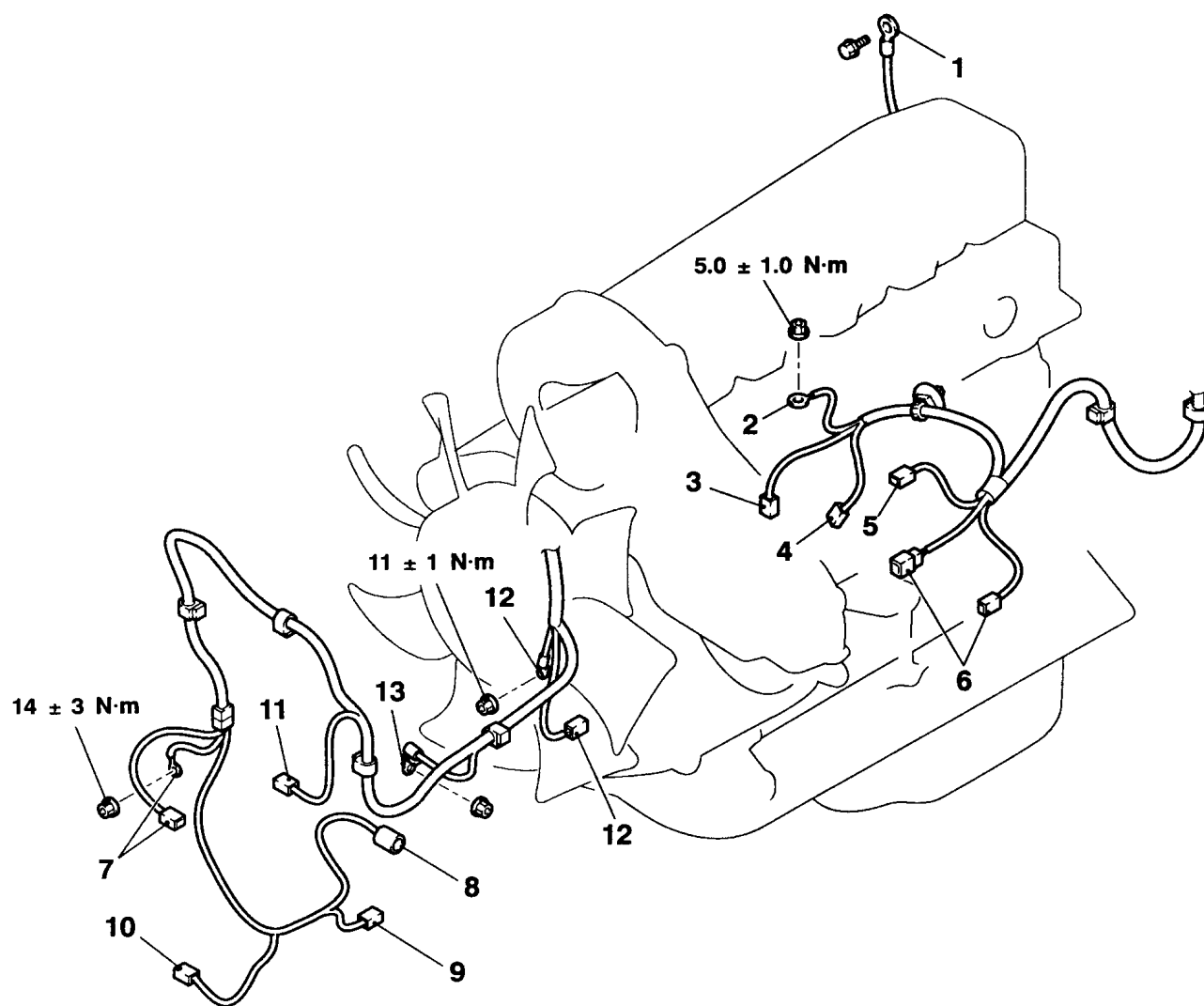
Tightening torque: 30 ± 6 N·m

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Hood Removal and Installation (Refer to GROUP 42.)
- Under Cover and Skid Plate Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 – On-vehicle Service.)
- Battery and Battery Tray Removal and Installation
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Radiator Removal and Installation (Refer to GROUP 14.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.) <Post-installation operation>
- Fuel Line Air-bleeding (Refer to GROUP 13B – On-vehicle Service.) <Post-installation operation>
- Drive Belt Tension Check and Adjustment <Vehicles with A/C> (Refer to P.11B-6.) <Post-installation operation>



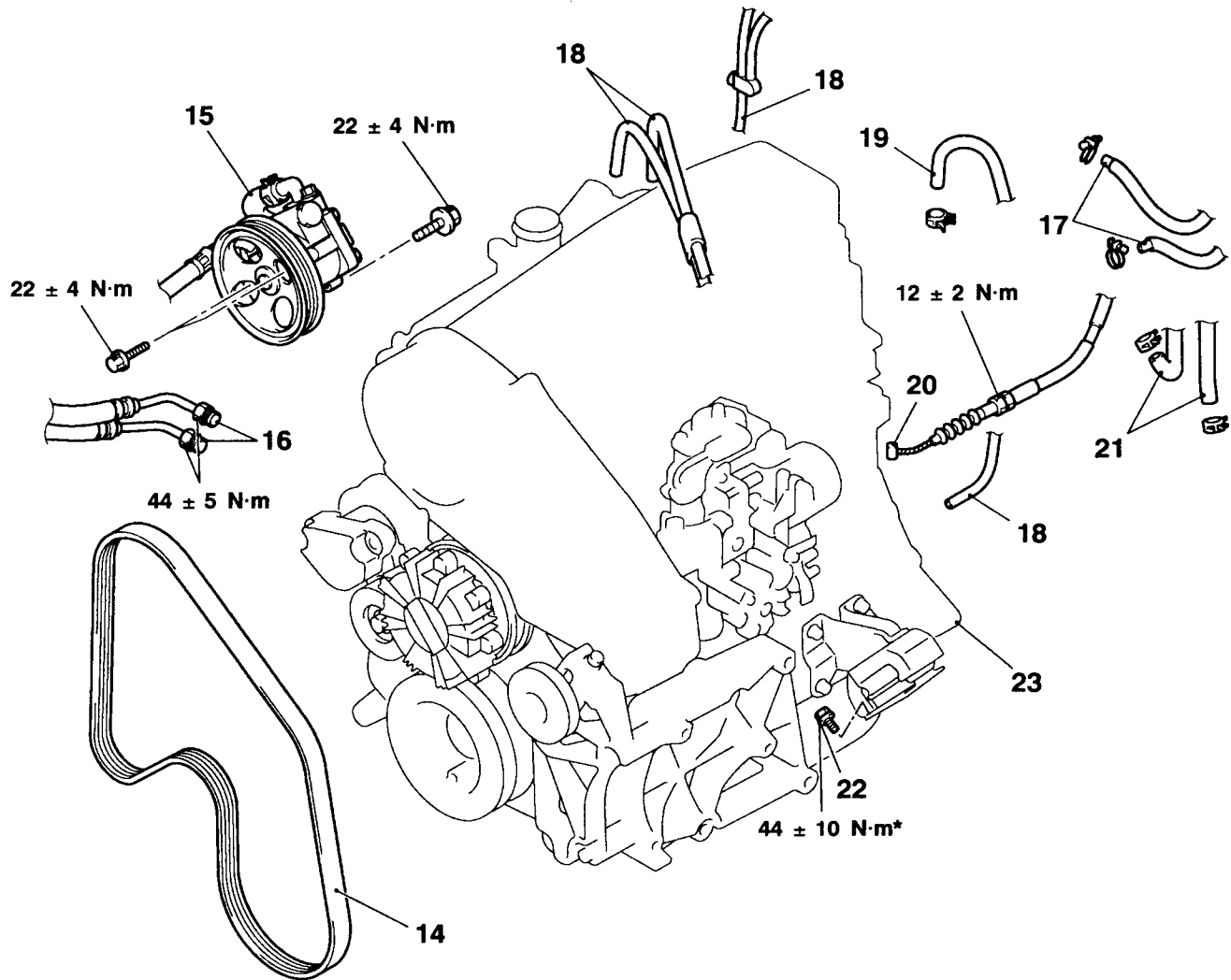
AY0279CA

Removal steps

1. Earth cable connection
2. Glow plug connector
3. Engine coolant temperature switch connector (for A/C compressor control)
4. Engine coolant temperature switch connector (for condenser fan control)
5. Fuel cut solenoid valve connector
6. Injection pump connector
7. Alternator connector
8. Oil pressure switch connector
9. Engine oil level sensor connector
10. Free-wheeling hub engage switch
11. A/C compressor connector <Vehicles with A/C>
12. Starter connector
 - A/C compressor assembly <Vehicles with A/C> (Refer to P.11B-19.)
13. Earth cable connection

Caution

*: indicates parts which should be temporarily tightened, and then fully tightened with the engine weight applied on the vehicle body.



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◀A▶

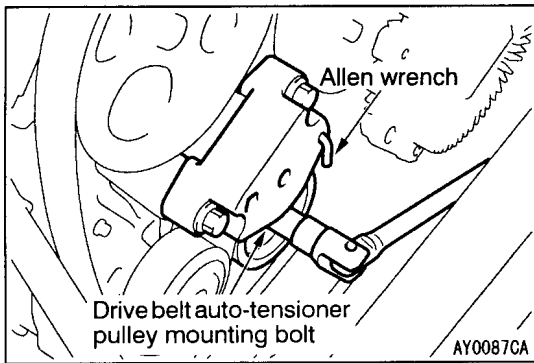
◀B▶

- Cooling fan
(Refer to GROUP 14.)
- 14. Alternator and power steering oil pump drive belt
- 15. Power steering oil pump assembly
- 16. Engine oil cooler hoses connection
- 17. Fuel hoses connections
- 18. Vacuum hoses connection
- 19. Brake booster vacuum hose connection <Vehicles with ABS>

◀C▶

▶A▶

- 20. Accelerator cable connection
- 21. Heater hoses connection <Vehicles with A/C>
- Transmission assembly
(Refer to GROUP 22.)
- 22. Engine support front insulator attaching bolt
- 23. Engine assembly



REMOVAL SERVICE POINTS

◀A▶ ALTERNATOR AND POWER STEERING PUMP DRIVE BELT REMOVAL

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

1. Locate a ring spanner onto the drive belt auto-tensioner pulley mounting bolt, and move the tensioner clockwise until it touches the stopper.
2. Hold the tensioner by inserting an Allen wrench as shown, and remove the drive belt.

Caution

To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

◀B▶ POWER STEERING OIL PUMP ASSEMBLY REMOVAL

1. Remove the power steering oil pump assembly from the timing gear case with its hoses still attached.
2. Suspend the power steering oil pump with a cord out of the way.

◀C▶ ENGINE ASSEMBLY REMOVAL

1. Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
2. Lift the 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.

ENGINE <4M4>

CONTENTS

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Valve Clearance Check and Adjustment	8	CYLINDER HEAD GASKET	27
Injection Timing Check and Adjustment	9	ENGINE ASSEMBLY	33
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GENERAL INFORMATION

Items			4M41
Total displacement ml			3,200
Bore × Stroke mm			98.5 × 105.0
Compression ratio			17.0
Camshaft arrangement			DOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 13°
		Closing	ABDC 31°
	Exhaust	Opening	BBDC 55°
		Closing	ATDC 17°
Fuel system			Distribution type injection pump
Rocker arm			Roller type

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Alternator drive belt (When inspection)	Vibration frequency Hz		122 – 161	—
	Tension N		207 – 363	—
	Deflection mm <Reference>		8 – 11	—
Alternator drive belt (When adjustment)	Vibration frequency Hz		122 – 136	—
	Tension N		207 – 259	—
	Deflection mm <Reference>		10 – 11	—
Alternator drive belt (When replacement)	Vibration frequency Hz		149 – 161	—
	Tension N		311 – 363	—
	Deflection mm <Reference>		8 – 9	—
A/C compressor drive belt (When inspection)	Vibration frequency Hz	A	177 – 191	—
		B	145 – 156	—
	Tension N	C	343 – 392	—
	Deflection mm <Reference>	C	7.5 – 8.5	—
A/C compressor drive belt (When adjustment)	Vibration frequency Hz	A	177 – 191	—
		B	145 – 156	—
	Tension N	C	343 – 392	—
	Deflection mm <Reference>	C	7.5 – 8.5	—
A/C compressor drive belt (When replacement)	Vibration frequency Hz	A	177 – 191	—
		B	145 – 156	—
	Tension N	C	490 – 539	—
	Deflection mm <Reference>	C	6.0 – 6.5	—

Items		Standard value	Limit
Valve clearance(at cold engine) mm	Intake valve	0.1	–
	Exhaust valve	0.15	–
Injection timing		4°BTDC	–
Idle speed r/min		750 ± 20	–
Compression pressure kPa–r/min		2,844–240	2,256–240
Compression pressure difference of all cylinder kPa		–	Maximum 294

NOTE

A: Between crankshaft pulley and tension pulley

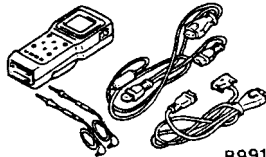
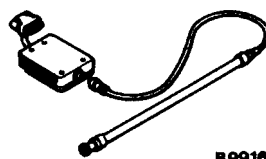
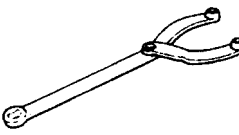
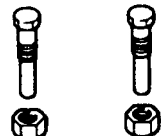
B: Between crankshaft pulley and A/C compressor pulley

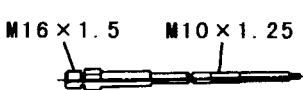
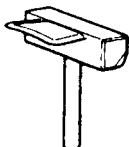
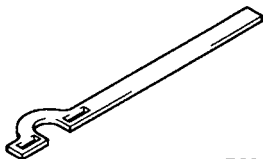
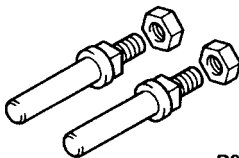
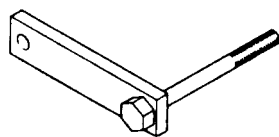
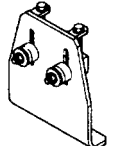
C: Between A/C compressor pulley and tension pulley

SEALANTS AND ADHESIVES

Items	Specified Sealants	Remarks
Oil pan cover rubber	3M ATD Part No. 8121 or equivalent	Quick fix adhesive
Engine cover insulator		
Contact surface between timing gear case and crankcase assembly	3M ATD Part No. 8660 or equivalent	Semi-drying sealant
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	
Timing gear case		

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub-assembly	• Drive belt tension measurement • Fuel injection timing check and adjustment • Idle speed check
 B991668	MB991668	Belt tension meter set	Drive belt tension measurements (Use with MUT-II)
	MB990767	Endyoke holder	Crankshaft pulley holding
	MD998754	Pulley holder pin	

Tool	Number	Name	Use
 MH063494	MH063494	Compression gauge adapter	Compression pressure check
	MD998727	Oil pan remover	Oil pan removal
 B991800	MB991800	Pulley holder	Crankshaft pulley holding
 B991802	MB991802	Pin B	
	MD998781	Flywheel stopper	Flywheel<M/T> or drive plate<A/T> holding
	MH063490	Cam sprocket holder kit	Camshaft sprocket holding

ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

1. Check the drive belt tension by the following procedures.

Standard value:

Item	During inspection	During adjustment	During replacement
Vibration frequency Hz	122 – 161	122 – 136	149 – 161
Tension N	207 – 363	207 – 259	311 – 363
Deflection mm <Reference>	8.0 – 11.0	10.0 – 11.0	8.0 – 9.0

<When using MUT-II>

- (1) Connect the MUT-II to the special tool (MB991668).
- (2) Connect the MUT-II to the diagnosis connector.

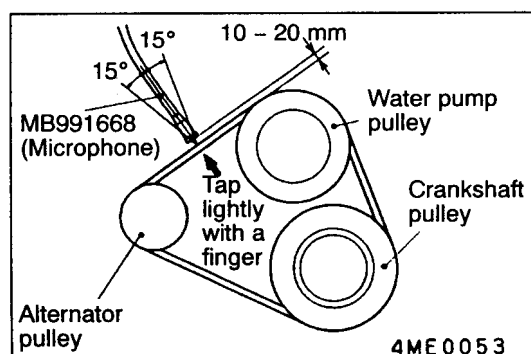
Caution

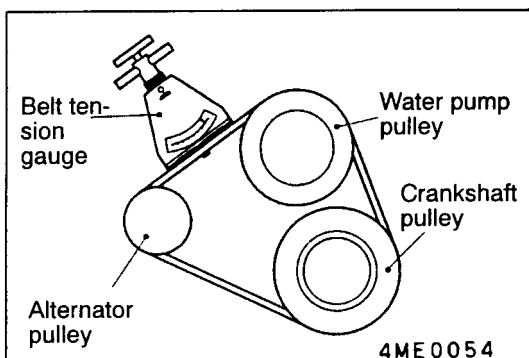
Always turn the ignition switch to LOCK (OFF) position before disconnecting or connecting the MUT-II.

- (3) Turn the ignition switch to ON, and select the “Belt tension measurement” on the menu screen.
- (4) Hold a microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), approximately 10 – 20 mm 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) Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

Caution

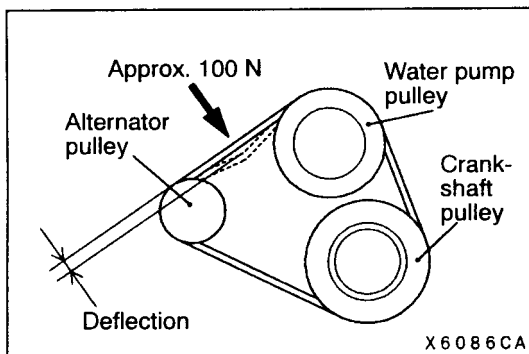
- 1) The temperature of the surface of the belt should be as close to normal temperature as possible.
- 2) Do not allow any contaminants such as water or oil to get onto the microphone.
- 3) If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values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





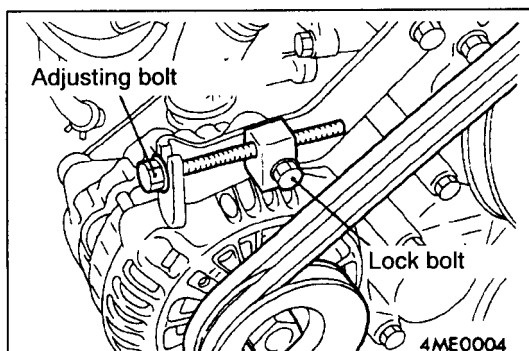
<When using a tension gauge>

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



<When checking the deflection>

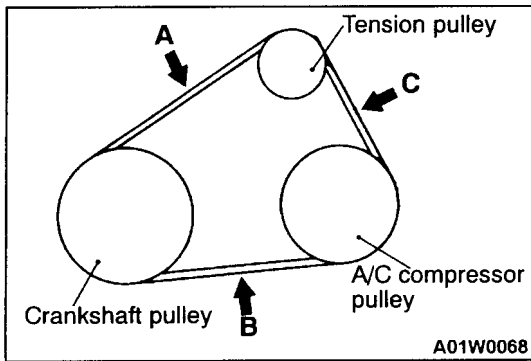
Apply approx. 100 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.



2. If not within the standard value, adjust the belt tension by the following procedure.
 - (1) Loosen the pivot nut.
 - (2) Loosen the lock bolt.
 - (3) Turn the adjusting bolt to adjust the belt deflection.
 - (4) Tighten the lock bolt and pivot nut to the specified torque.
 - (5) Crank the engine clockwise one turn or more, and then check the belt tension.

Caution

These V belts must always be replaced as a set, being careful to keep them clear of oil or grease.



A/C compressor drive belt tension check and adjustment<Vehicles with A/C>

1. Check the drive belt tension by the following procedures.

Standard value:

Item		During inspection	During adjustment	During replacement
Vibration frequency Hz	A	177 – 191	177 – 191	177 – 191
	B	145 – 156	145 – 156	145 – 156
Tension N	C	343 – 392	343 – 392	490 – 539
Deflection mm <Reference>	C	7.5 – 8.5	7.5 – 8.5	6.0 – 6.5

<When using MUT-II>

Gently tap the center of the belt between the pulleys (arrows A and B), and check that the belt vibration frequency is within the standard value.

NOTE

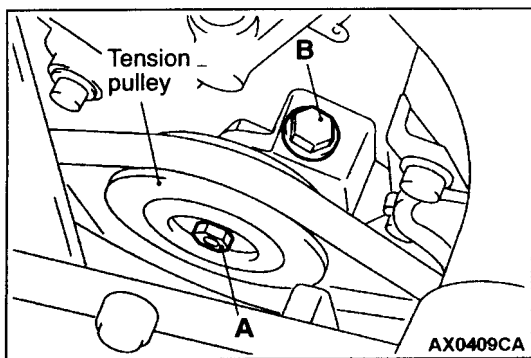
For the vibration frequency measurement using the MUT-II, refer to P.11C-5.

<When using a tension gauge>

Place a belt tension gauge at the center between the pulleys (arrow C) to check the belt tension is within the standard value.

<When checking the deflection>

Apply approx. 100 N of pressure against the location between the pulleys shown by the arrow C in the illustration and then measure the deflection.



2. If not within the standard value, adjust the belt tension by the following procedure.

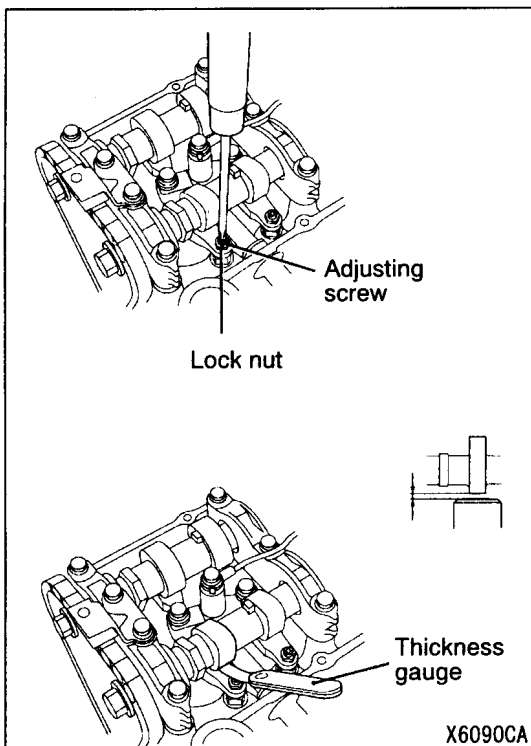
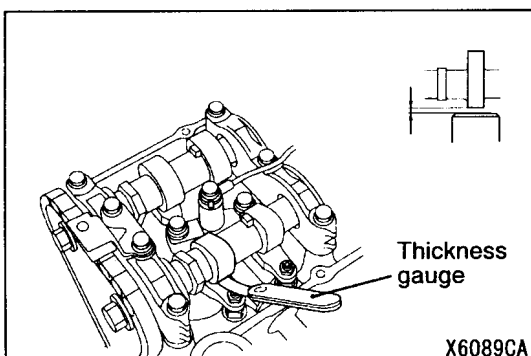
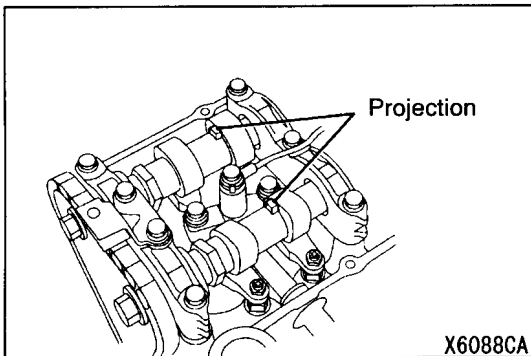
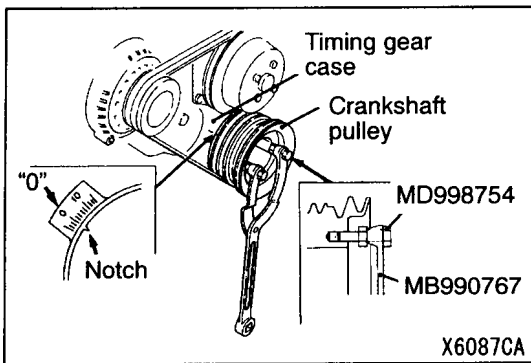
- (1) Loosen the tension pulley securing bolt A.
- (2) Use the adjusting bolt B to adjust the belt deflection.
- (3) Tighten the securing bolt A to the specified torque.

Tightening torque: 44 ± 10 N·m

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

Caution

When checking the belt tension, turn the crankshaft clockwise one turn or more.



VALVE CLEARANCE CHECK AND ADJUSTMENT

NOTE

The valve clearance check and adjustment should be done when the engine is cold.

1. Remove the rocker cover.
2. Remove all the glow plugs.
3. Use the special tool to turn the crankshaft clockwise, and align the notch on the crankshaft pulley with timing mark "0" to set the No.1 cylinder or No.4 cylinder to the top dead centre of its compression stroke.

Caution

Never turn the crankshaft anticlockwise, or the tensioner for adjusting the timing chain tension at the timing gear can be damaged.

If it is turned anticlockwise, once remove the tensioner and reinstall.

NOTE

If the projection on the camshaft faces up, the No.1 cylinder is on the top dead centre of its compression stroke. When the crankshaft is turned just one more turn, the No.4 cylinder is at top dead centre.

4. When the No.1 or No.4 piston is on the top dead centre of its compression stroke, use a thickness gauge to measure the valve clearance indicated by the circle in the table below.

When the No.1 cylinder is at compression top dead centre:

Cylinder No.	1	2	3	4
Intake	○	○	—	—
Exhaust	○	—	○	—

When the No.4 cylinder is at compression top dead centre:

Cylinder No.	1	2	3	4
Intake	—	—	○	○
Exhaust	—	○	—	○

Standard value:

Intake side 0.1 mm

Exhaust side 0.15 mm

NOTE

If the thickness gauge is inserted and pulled out with resistance, its reading will be accurate.

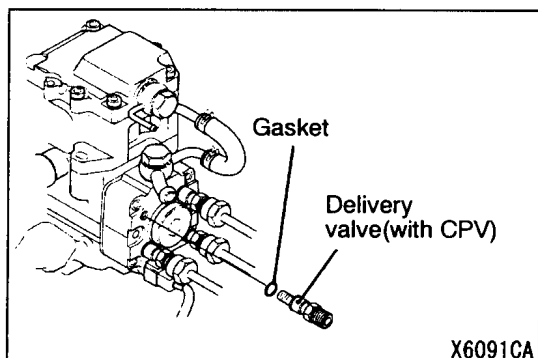
If the thickness gauge can be inserted and pulled out smoothly without resistance, its reading will be inaccurate.

5. If not at the standard value, adjust by the following procedure.
 - (1) Loosen the lock nut, and tighten the adjusting screw so that the thickness gauge can be passed with a slight drag.

- (2) After adjustment, tighten the lock nut to the specified torque while preventing the adjusting screw from turning with a screwdriver.

Tightening torque: 9.5 ± 0.5 N·m

- (3) Measure the valve clearance again, and check that it is at the standard value.



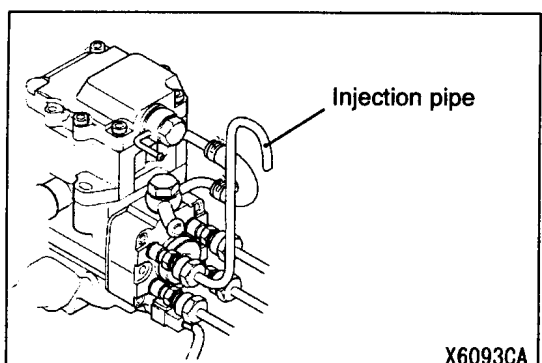
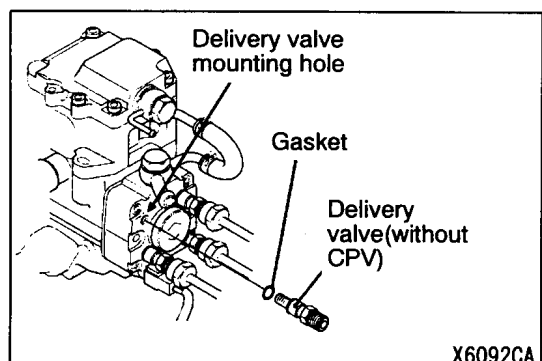
INJECTION TIMING CHECK AND ADJUSTMENT

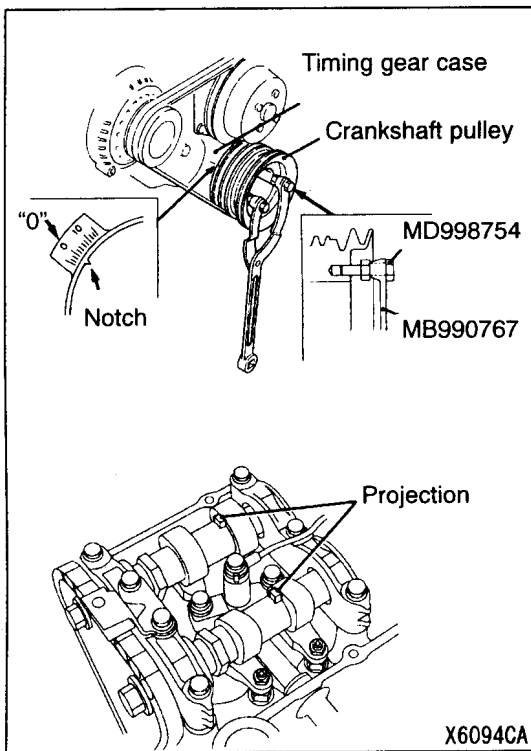
1. Warm up the engine.
2. Remove all the glow plugs.
3. Remove the No.1 cylinder delivery valve (with CPV) and gasket of the injection pump.

4. Install the gasket (ME741133) and delivery valve(without: MH063483) to the injection pump delivery valve mounting hole, and tighten them to the specified torque.

Tightening torque: 49 ± 5 N·m

5. Install an old the auxiliary injection pipe to the delivery valve. Cut out the open end of the injection pipe, and bend it down so as to observe the fuel flow.





6. Use the special tool to turn the crankshaft clockwise, align the notch on the crankshaft pulley with the "0" timing mark to set the No.1 cylinder to the top dead centre of its compression stroke.

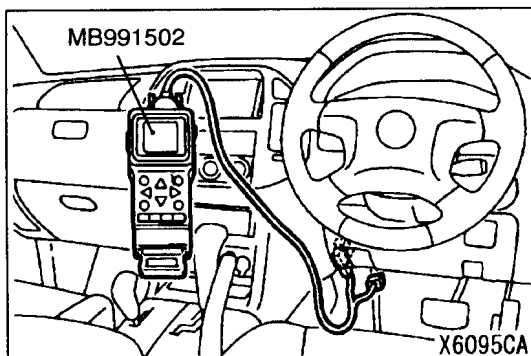
Caution

Never turn the crankshaft anticlockwise, or the tensioner for adjusting the timing chain tension at the timing gear can be damaged. If it is turned anticlockwise, once remove it and reinstall.

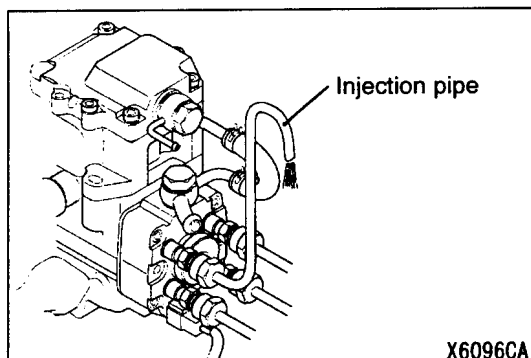
NOTE

Remove the filler cap, and check the camshaft condition. If the camshaft projection faces up, the No.1 cylinder is on top dead centre of its compression stroke.

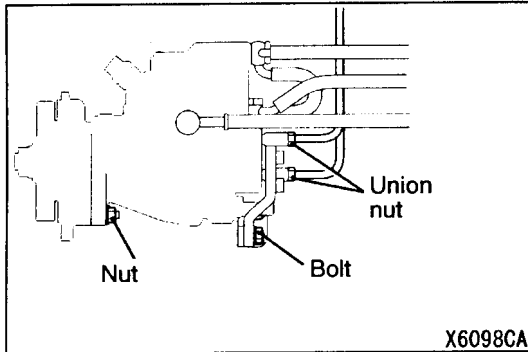
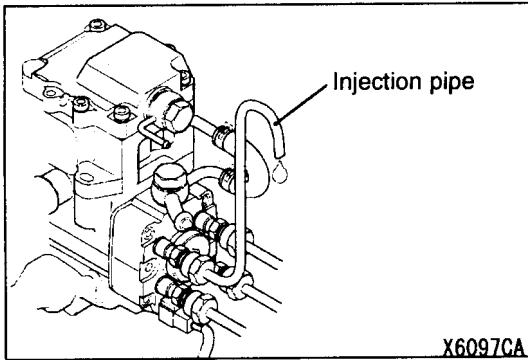
7. Turn the crankshaft pulley clockwise, and set the No.1 cylinder to before top dead centre 30° of its compression stroke.



8. Turn the ignition switch to "LOCK"(OFF), and connect the diagnosis connector to the MUT-II.
9. Turn the ignition switch ON.
10. Carry out the actuator test (No.34) on MUT-II.



11. Supply the fuel by operating the fuel filler hand pump, and turn the engine clockwise while allowing the fuel to flow through the injection pipe.



12. If the fuel flow through the injection pipe decreases, turn the engine more slowly. Then stop turning the engine when the fuel flow stops completely. Check the fuel injection timing during this condition.

Standard value: 4° BTDC

13. If not at the standard value, adjust by the following procedure.

- (1) Loose the fuel injection pipe union nut, the injection pump securing bolt and nut in that order.

Caution

a. When the union nut is loosened, use a open end wrench to prevent the delivery valve holder from rotating with it.

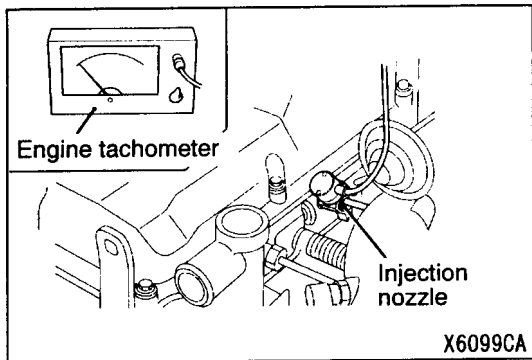
b. Do not remove the bolt and nut at this time.

- (2) Tilt the injection pump housing to the left or the right to adjust.
(3) Tilt the injection pump mounting nut and bolt temporarily.
(4) Repeat steps 9 – 12 to check that the injection timing is correct.
(5) Tilt the injection pump mounting nut and bolt securely.
(6) Loose the fuel injection pipe union nut securely.

Caution

Hold the delivery pipe holder with a open end wrench when tightening the union nut.

14. Remove the special tool.
15. Install the delivery valve (with CPV) and the new gasket.
16. Install the glow plugs.



IDLE SPEED CHECK

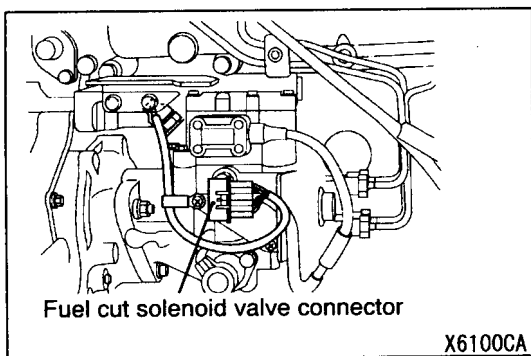
1. Set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position, and connect the diagnosis connector to the MUT-II.
If the MUT-II is not used, connect an engine tachometer to the injection nozzle or the pipe.
3. Start the engine, and let it run at idle.
4. Check the idle speed.

Standard value: 750 ± 20 r/min

5. If the idle speed is not within the standard value, refer to 13C – Troubleshooting to check the electronic controlled fuel injection system.

NOTE

The idle speed is controlled by the engine-ECU.



COMPRESSION PRESSURE CHECK

1. Check that the engine oil, the starter motor and the battery is in good condition. In addition, set the vehicle to the pre-inspection condition.
2. Remove all the glow plugs.
3. Disconnect the fuel cut solenoid valve connector.

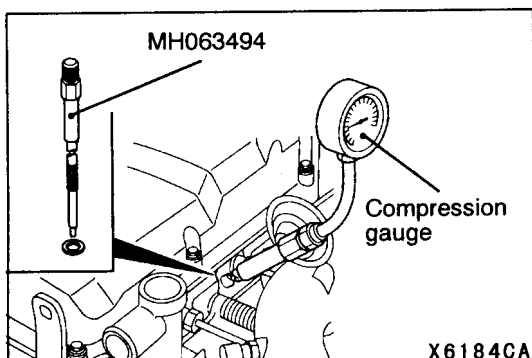
NOTE

Doing this will prevent carrying out fuel injection.

4. Plug the glow plug mounting holes with a shop towel, crank the engine, and then check that the shop towel is not contaminated with foreign material.

Caution

- 1) Keep away from the glow plug mounting holes when cranking the engine.
- 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 glow plug holes, which is dangerous.



5. Install the special tool to the glow plug mounting holes, and install the compression gauge.
6. Measure the compression pressure while cranking the engine.

Standard value: 2844 kPa – 240 r/min

Limit value: 2256 kPa – 240 r/min

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

Limit: 294 kPa in maximum

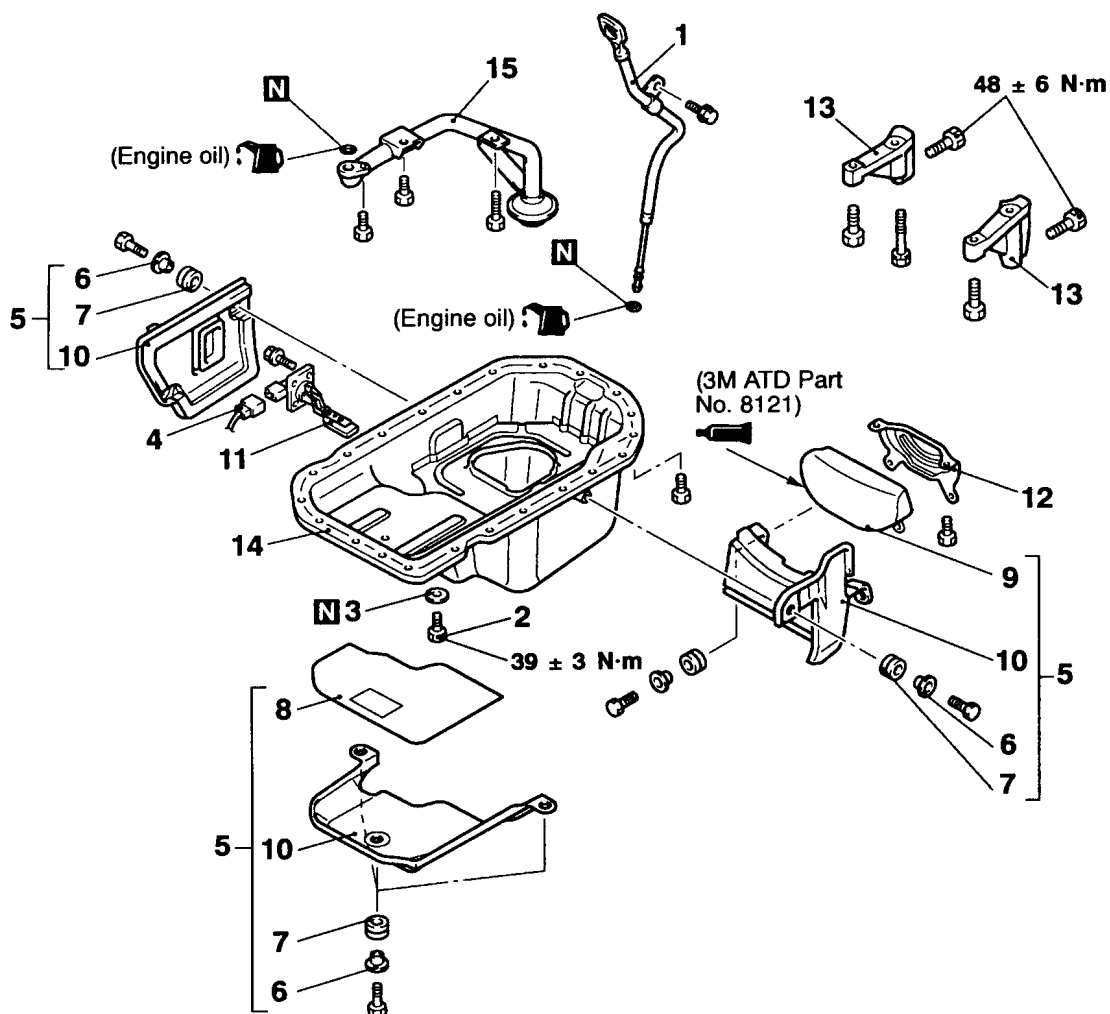
8. If there is a cylinder which compression or compression difference is outside the limit, pour a small amount of engine oil through the glow plug hole, and repeat the operations in steps 6 – 7.
 - (1) If the compression increases after the oil is added, the cause of the malfunction is a worn or damaged piston ring and /or cylinder inner surface.
 - (2) If the compression does not rise after the oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the fuel cut solenoid valve connector.
10. Install the glow plugs.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

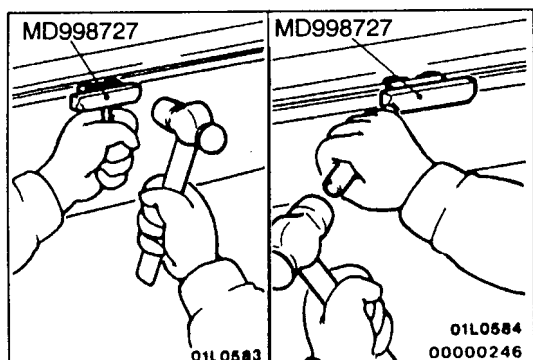
- Skid Plate and Under Cover Removal and Installation
- Engine Oil Draining and Refilling
(Refer to GROUP 12 - On-vehicle Service.)
- Differential Gear Oil Draining and Refilling
(Refer to GROUP 26 - On-vehicle Service.)
- Front Differential and No.2 Crossmember Assembly
Removal and Installation
(Refer to GROUP 11A - Oil Pan.)



AX1627CA

Removal steps

- B◄
1. Engine oil level gauge and guide assembly
 2. Drain plug
 3. Drain plug gasket
 4. Engine oil level sensor connector
 5. Oil pan cover assembly
 6. Insulator collar
 7. Insulator
 8. Oil pan rubber
 9. Rubber
 10. Oil pan cover
 11. Engine oil level sensor
 12. Dust cover
 13. Stiffener
 14. Oil pan
 15. Oil screen
- ◄A► ►A◄

**REMOVAL SERVICE POINT****◀A▶ OIL PAN REMOVAL****INSTALLATION SERVICE POINTS****▶A◀ OIL PAN INSTALLATION**

1. Clean the gasket mating surfaces of the oil pan, the timing gear case and the crankcase assembly with a scraper or a wire brush.
2. Apply the specified sealant to the mating surface of the timing gear case and crankcase.

Specified sealant: 3M ATD Part No.8660 or equivalent

3. Apply a continuous bead of the specified sealant to the oil pan mating surface as shown.

Specified sealant:

MITSUBISHI GENUINE PART MD970389 or equivalent

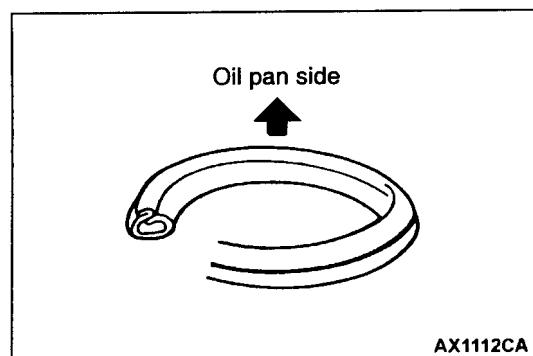
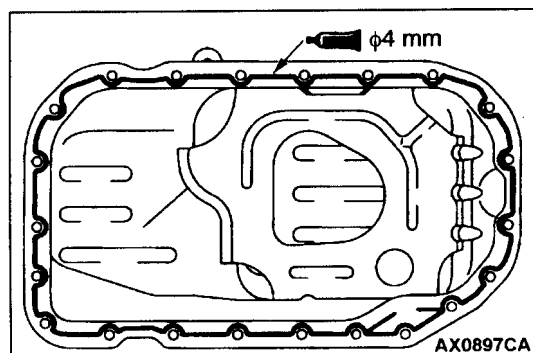
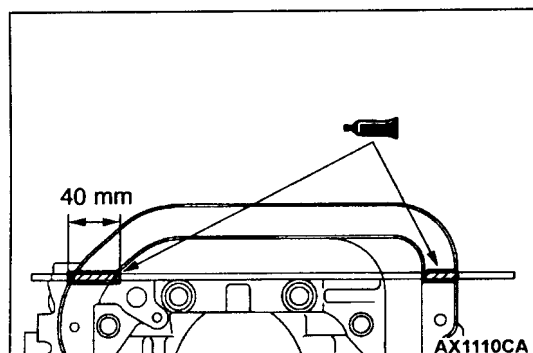
4. After applying the sealant, install the oil pan within 15 minutes.

Caution

- (1) When installing the oil pan, be careful not to disturb the sealant.
- (2) Whenever the oil pan mounting bolts are loosened or tightened again after the oil pan installation, always apply the sealant again.
- (3) After the oil pan is installed, wait for at least one hour, and then start the engine.

▶B◀ DRAIN PLUG GASKET INSTALLATION

Always replace the gasket with a new one so that it faces the direction shown.

**INSPECTION**

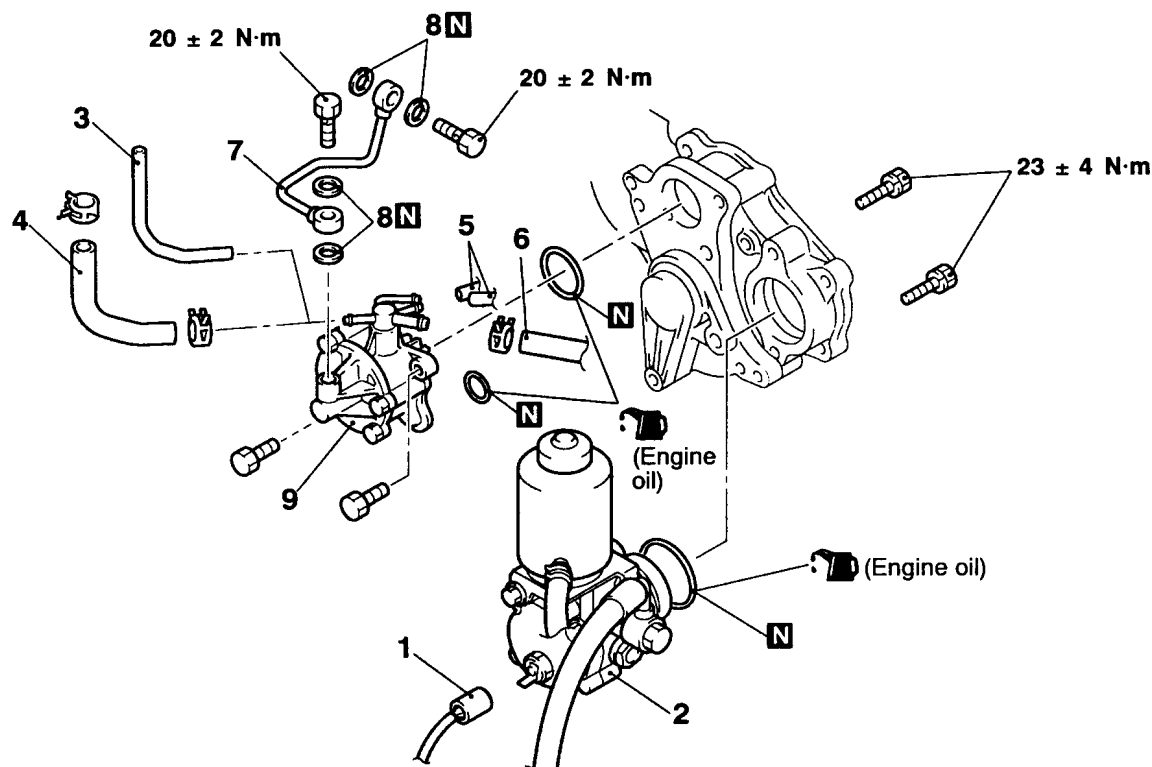
- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.

VACUUM PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Cover Removal and Installation
(Refer to P.11C-23.)
- Battery and Battery Tray Removal and Installation
- Engine Oil Check and Refill
(Refer to GROUP 12 – On-vehicle Service.)
<Post-installation operation>



AX1654CA

Removal steps

1. Power steering oil pressure switch connector
2. Power steering oil pump assembly
3. Vacuum hose
<Except R.H. drive vehicles without ABS>
4. Vacuum hose
<R.H. drive vehicles without ABS>
5. Vacuum hose connection
6. Brake booster vacuum hose connection
<L.H. drive vehicles without ABS>
7. Vacuum pump oil pipe
8. Vacuum pump oil pipe gasket
9. Vacuum pump assembly

REMOVAL SERVICE POINT**◀A▶ POWER STEERING OIL PUMP ASSEMBLY REMOVAL**

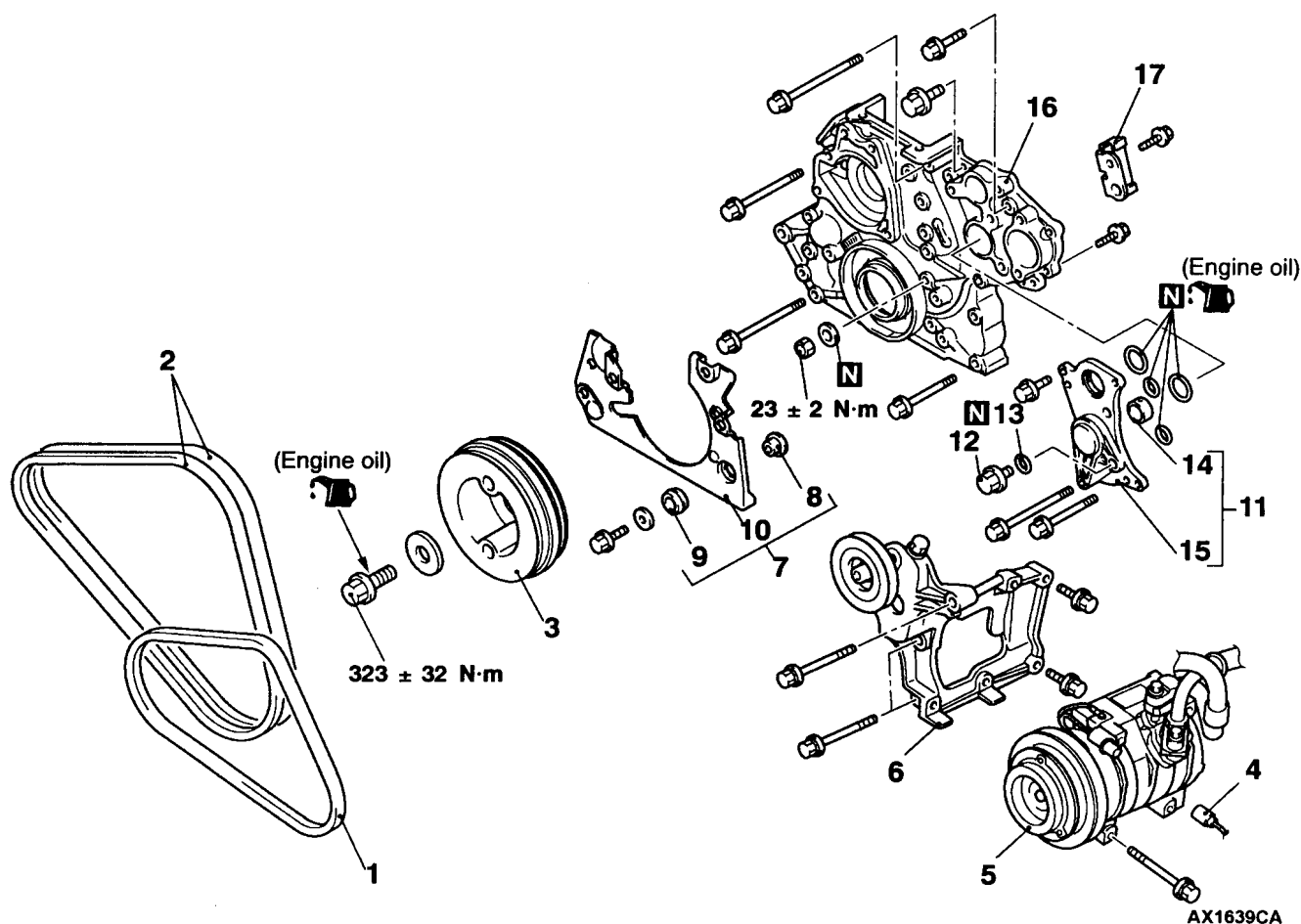
1. Remove the power steering oil pump assembly from the timing gear case with its hoses still attached.
2. Support the oil pump aside with a cord.

TIMING CHAIN

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- Engine Coolant Drain and Refill
(Refer to GROUP 14 – On-vehicle Service.)
- Under Cover and Skid Plate Removal and Installation
- Engine Oil Draining and Refilling
(Refer to GROUP 12 – On-vehicle Service.)
- Fuel Line Air-bleeding
(Refer to GROUP 13C – On-vehicle Service.)
<Post-installation operation>
- Drive Belt Tension Check and Adjustment
(Refer to P.11C-5.)<Post-installation operation>
- Camshaft Removal and Installation
(Refer to P.11C-23.)
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Vacuum Pump Removal and Installation
(Refer to P.11C-16.)
- Oil Pan Removal and Installation(Refer to P.11C-14.)

**Removal steps**

◀A▶

1. A/C compressor drive belt
<Vehicles with A/C>

◀B▶

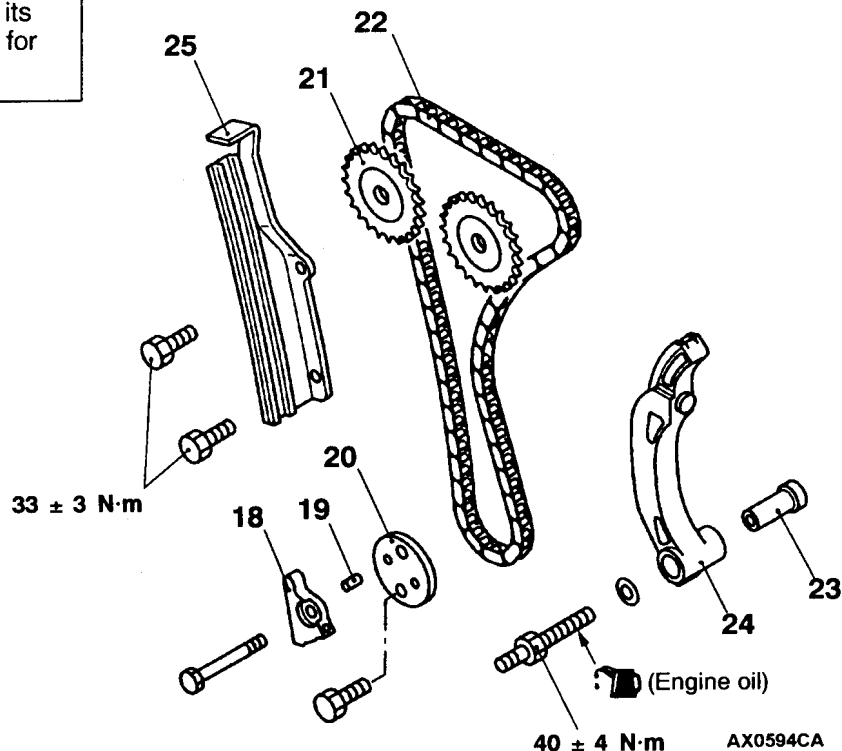
2. Alternator drive belt
3. Crankshaft pulley
 - Alternator(Refer to GROUP 16.)
 - Water pump(Refer to GROUP 14.)
 - Cylinder Head Assembly
(Refer to P.11C-27.)

◀C▶

4. A/C compressor connector
<Vehicles with A/C>
5. A/C compressor
<Vehicles with A/C>
6. A/C compressor bracket and tension pulley assembly<Vehicles with A/C>

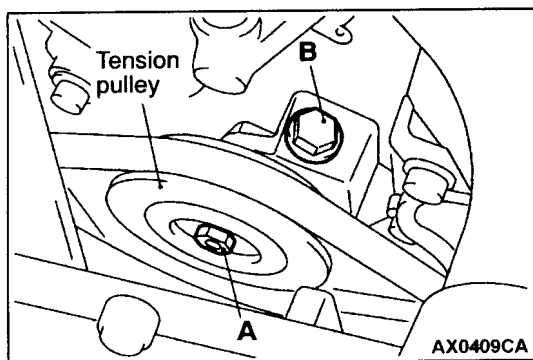
7. Timing gear case cover assembly
8. Insulator collar
9. Insulator
10. Timing gear case cover
11. Bearing block assembly
12. Drain plug
13. Drain plug gasket
14. Bearing block bushing
15. Bearing block
16. Timing gear case
17. Lower guide plate

Apply engine oil to the timing chain and its contact surfaces for installation.



- ▶A◀ 18. Oil jet
- ▶A◀ 19. Spring pin
- ▶A◀ 20. Idler washer
- ▶A◀ 21. Camshaft sprocket

- ▶A◀ 22. Timing chain
- ▶A◀ 23. Tension lever shaft
- ▶A◀ 24. Tension lever
- ▶A◀ 25. Guide plate



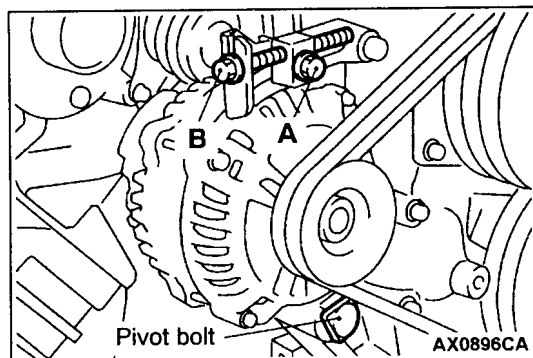
REMOVAL SERVICE POINTS

◀A▶ A/C COMPRESSOR DRIVE BELT REMOVAL

1. Loosen the tension pulley securing bolt A.
2. Loosen the adjusting bolt B to remove the belt.

Caution

To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.



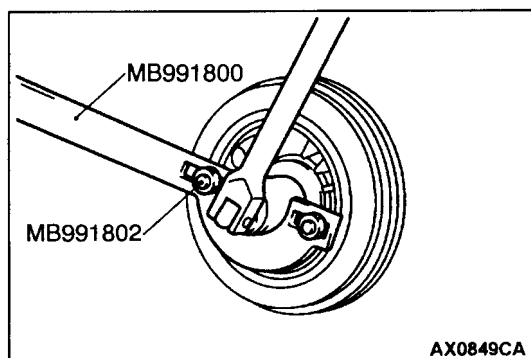
◀B▶ ALTERNATOR DRIVE BELT REMOVAL

1. Loosen the alternator pivot bolt, nut and the securing bolt A.
2. Loosen the adjusting bolt B to remove the belts.

Caution

- (1) To reuse the drive belts, mark its running direction (clockwise direction) on the belt backside with a chalk.
- (2) To replace the drive belts, always replace them as a set.

◀C▶ CRANKSHAFT PULLEY REMOVAL



INSTALLATION SERVICE POINTS

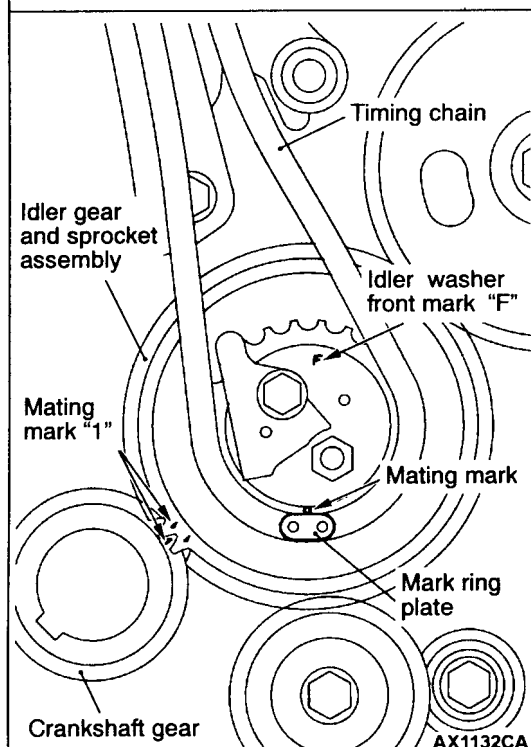
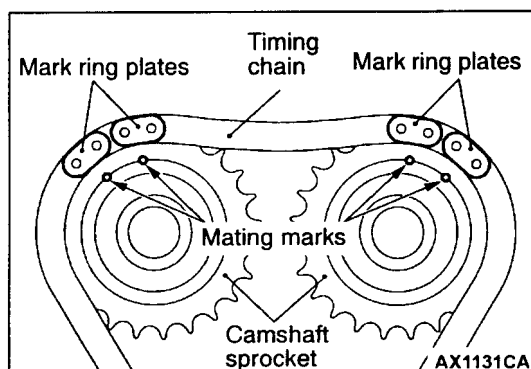
▶A◀ TIMING CHAIN/CAMSHAFT SPROCKET/IDLER WASHER/SPRING PIN/OIL JET INSTALLATION

1. Check that the mating mark on the idler gear and sprocket assembly is aligned with mating mark "1" on the crankshaft gear.
2. Align the mating mark on the idler gear and sprocket assembly with the dark blue mark ring plate on the timing chain.

Caution

Note that the timing chain has one mark ring plate for the idler gear and sprocket assembly side, and two mark ring plates for each camshaft sprocket.

3. Align the mark ring plates with the camshaft sprocket mating marks.
4. Tie up the timing chain and the camshaft sprocket with a cord to prevent the mating mark misalignment.
5. Install the idler washer, the spring pin and the oil jet. The idler washer front mark "F" must face toward the front of the engine.

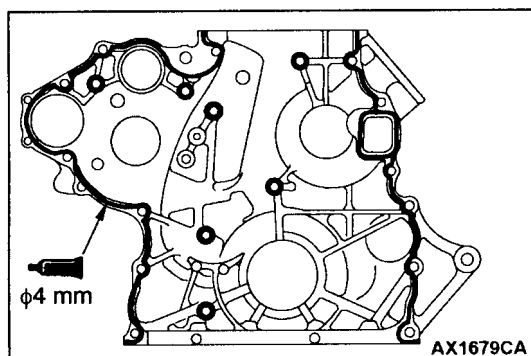


▶B◀ TIMING GEAR CASE/BEARING BLOCK ASSEMBLY INSTALLATION

1. Clean the timing gear case and the front plate mating surfaces with a scraper or a wire brush.
2. Apply a continuous bead of the specified sealant to the timing gear case mating surface as shown.

Specified sealant:

MITSUBISHI GENUINE PART MD970389 or equivalent

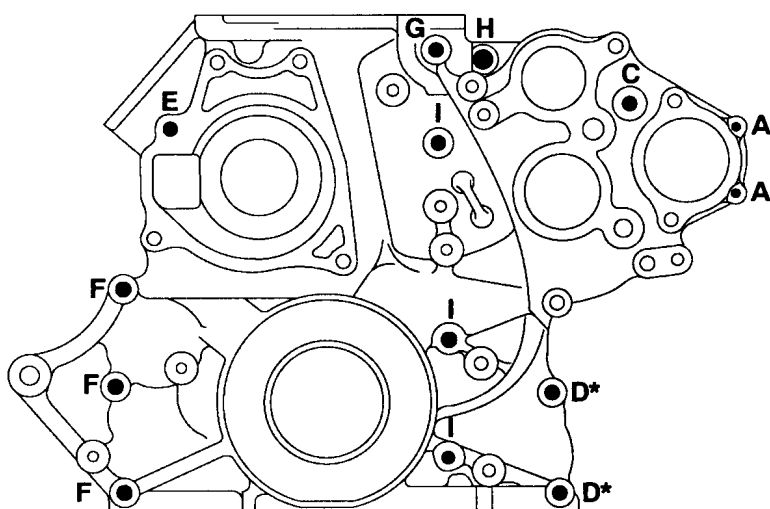


3. After applying the sealant, install the gear case within 15 minutes.

Caution

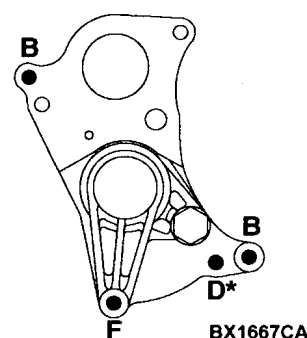
- (1) When installing the timing gear case, be careful not to disturb the sealant.
 - (2) Whenever the timing gear case mounting bolts are loosened or tightened again after the timing gear case installation, always apply the sealant again.
 - (3) After the timing gear case is installed, wait for at least one hour, and then start the engine.
4. Install the mounting nuts and bolts to the timing gear case and the bearing block assembly at the shown positions.

Timing gear case



BX1666CA

Bearing block assembly



Name	Symbol	Size mm (D × L)	Name	Symbol	Size mm (D × L)
Flange bolt	A	6 × 20	Flange bolt	F	8 × 85
	B	8 × 30		G	8 × 90
	C	8 × 50		H	10 × 35
	D*	8 × 60	Cap nut	I	–
	E	8 × 75			

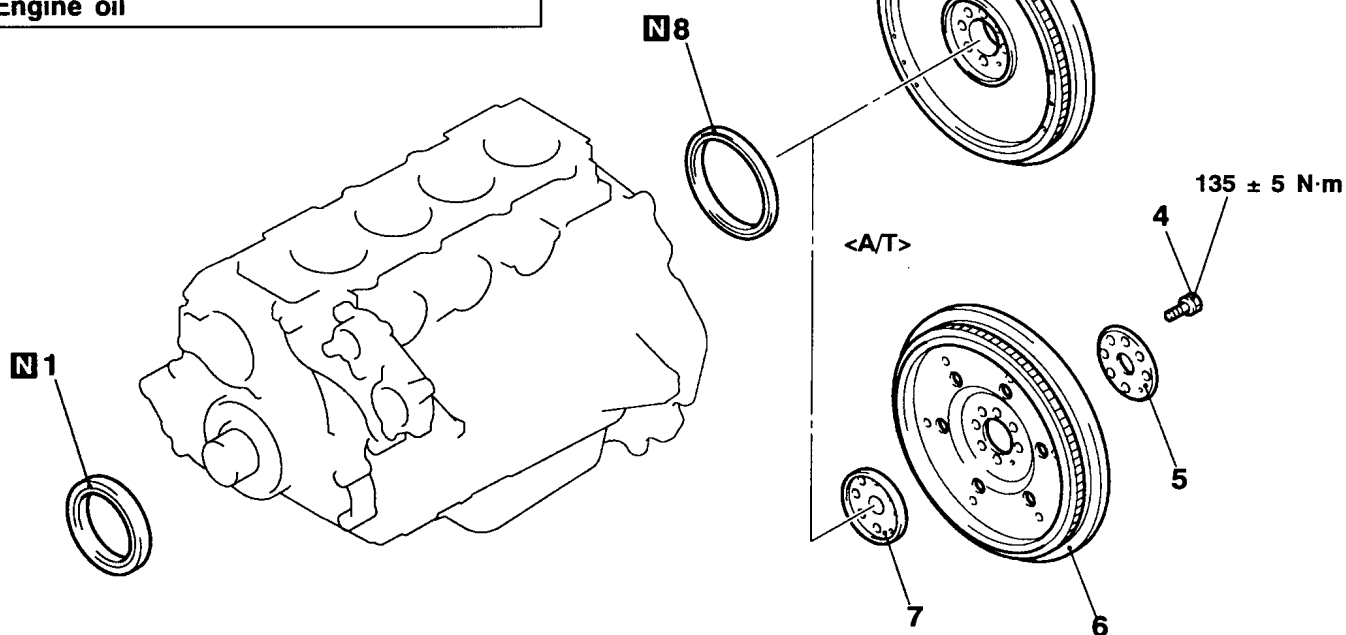
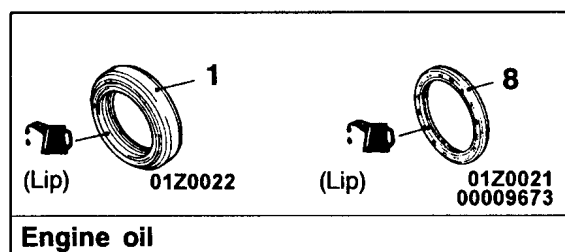
D=Nominal diameter

L=Nominal length

*: Vehicles without A/C

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION



AX1638CA

Crankshaft front oil seal removal steps

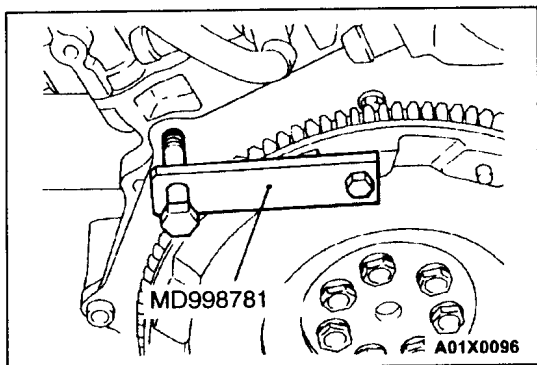
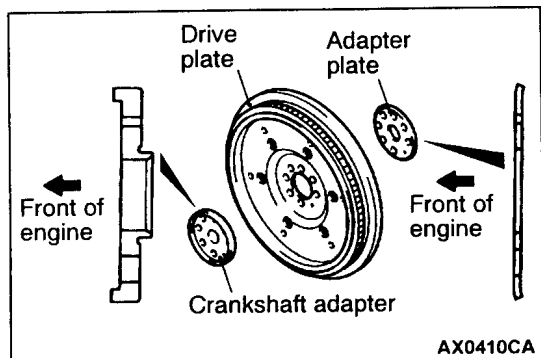
- Crankshaft pulley
(Refer to P.11C-17.)
- 1. Crankshaft front oil seal



Crankshaft rear oil seal removal steps

- <M/T>
- Transmission assembly
(Refer to GROUP 22.)
 - 2. Flywheel bolt
 - 3. Flywheel
 - 8. Crankshaft rear oil seal
- <A/T>
- Transmission assembly
(Refer to GROUP 23.)
 - 4. Drive plate bolt
 - 5. Adapter plate
 - 6. Drive plate
 - 7. Crankshaft adapter
 - 8. Crankshaft rear oil seal



**REMOVAL SERVICE POINT****◄A► FLYWHEEL BOLT/DRIVE PLATE BOLT REMOVAL****INSTALLATION SERVICE POINT****►A◄ CRANKSHAFT ADAPTER/DRIVE PLATE/ADAPTER PLATE INSTALLATION**

Assemble the crankshaft adapter and the adapter plate to the drive plate as shown, and then install the drive plate assembly into the crankshaft.

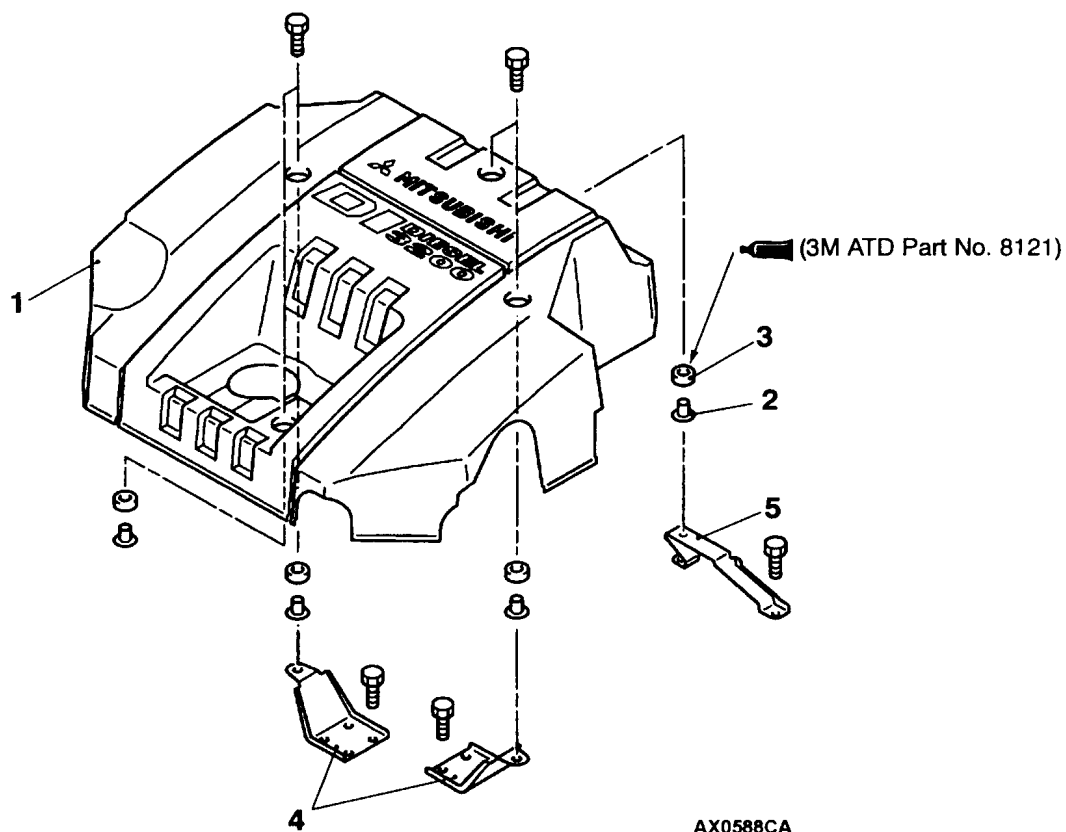
CAMSHAFT

REMOVAL AND INSTALLATION

Post-Installation Operation

Fuel Line Air-bleeding

(Refer to GROUP 13C – On-vehicle Service.)

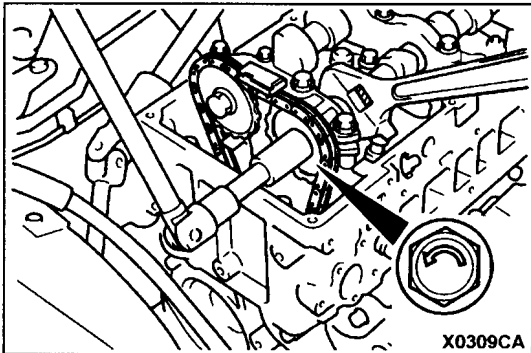
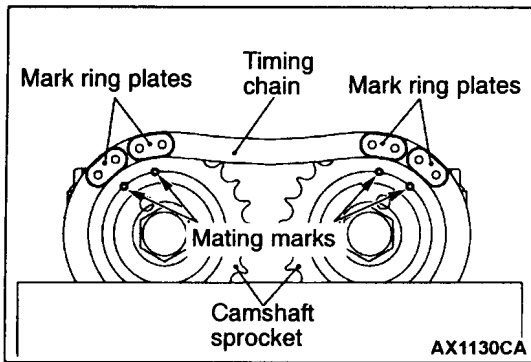
**Removal steps**

1. Engine cover assembly
2. Insulator collar
3. Insulator
4. Engine cover bracket
5. Engine cover bracket

- Air cleaner (Refer to GROUP 15.)
- EGR valve and EGR pipe assembly (Refer to GROUP 17 – EGR Valve.)



6. Breather hose
7. Rocker cover
8. Oil filler cap
9. Rocker cover gasket
10. Fuel leak-off pipe
11. Fuel leak-off pipe gasket
 • Valve clearance adjustment
 (Refer to P.11C-8.)
12. Chain tensioner
13. Chain tensioner gasket
14. Upper guide plate
15. Camshaft sprocket
16. Camshaft cap
17. Intake camshaft
18. Exhaust camshaft
19. Camshaft holder



REMOVAL SERVICE POINT

◀▶ CAMSHAFT SPROCKET REMOVAL

1. Turn the crankshaft clockwise, align the mating marks on the camshaft sprocket with the dark blue mark ring plates on the timing chain to set No.1 cylinder to TDC of its compression stroke.

Caution

Never turn the crankshaft anticlockwise.

2. Hold the hexagonal part of the camshaft with an open end wrench, loosen the camshaft sprocket bolts, and then remove the camshaft sprockets with the timing chain still attached.

Caution

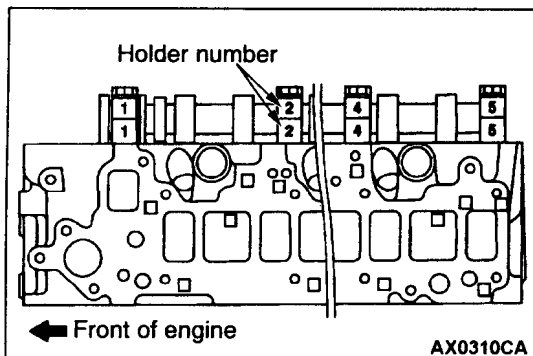
- (1) Use the timing chain to prevent the camshaft from turning.
 - (2) The camshaft sprocket bolt is left threaded, so the arrow indicating its tightening direction is marked on the bolt head. To loosen this bolt, turn the bolt to the opposite direction of the arrow.
 - (3) The timing chain must be attached to the camshaft sprockets.
3. Tie up the timing chain and the camshaft sprocket with a cord to prevent the mating mark misalignment.

INSTALLATION SERVICE POINTS

▶◀ CAMSHAFT HOLDER/CAMSHAFT CAP INSTALLATION

The holder numbers are stamped on the camshaft holders and the camshaft caps, so install them in that order and tighten to the specified torque.

Tightening torque: 20 ± 1 N·m



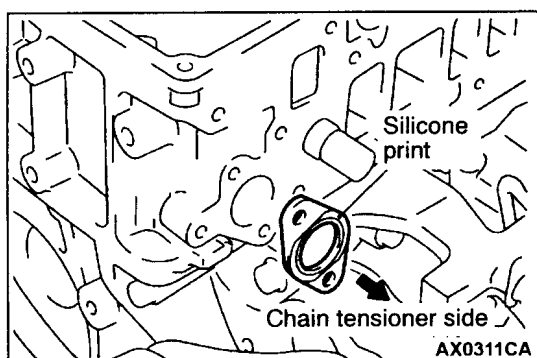
►B◄ CAMSHAFT SPROCKET INSTALLATION

1. Install the camshaft sprockets to the camshafts with the timing chain still attached.
2. Hold the hexagonal part of the camshaft with an open end wrench in the same manner as removal.
3. Apply a small amount of engine oil to the camshaft sprocket bolt thread and the flange, and then tighten to the specified torque.

Tightening torque: 88 ± 8 N·m

Caution

- (1) Use the timing chain to prevent the camshaft from turning.
- (2) The camshaft sprocket bolt is left threaded, so the arrow indicating its tightening direction is marked on the bolt head.

**►C◄ CHAIN TENSIONER GASKET INSTALLATION**

Place the chain tensioner gasket with its silicone print facing toward the chain tensioner side.

►D◄ CHAIN TENSIONER INSTALLATION

1. Bend up the tab as shown to push in the plunger, and lock it with the hook.
2. Install the chain tensioner to the cylinder head.

Caution

To install the chain tensioner, always push in the plunger. If you fail to do this, the timing chain will be excessively tensioned, causing damage.

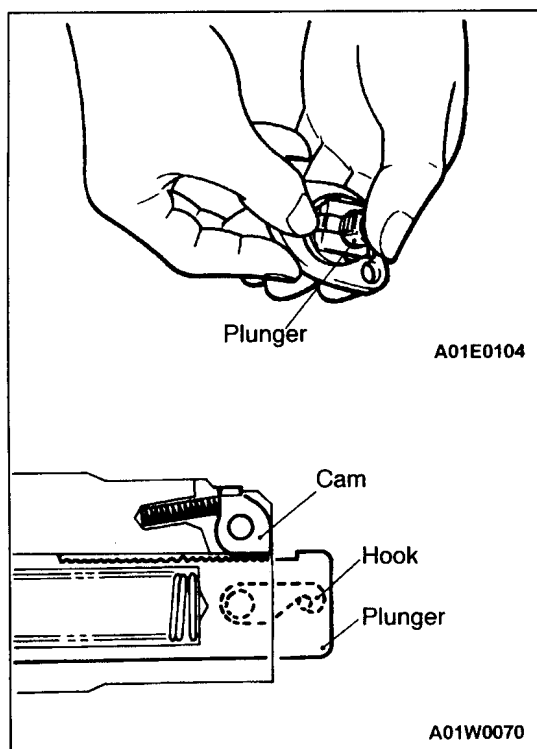
3. Turn the crankshaft clockwise.

Caution

If the crankshaft is turned anticlockwise after the chain tensioner is installed, the plunger will be excessively tensioned, causing the plunger to go beyond the cam inside the chain tensioner.

NOTE

If the crankshaft is turned clockwise after the chain tensioner is installed, the plunger is automatically unhooked. Then its internal ratchet mechanism adjusts the timing chain tension.

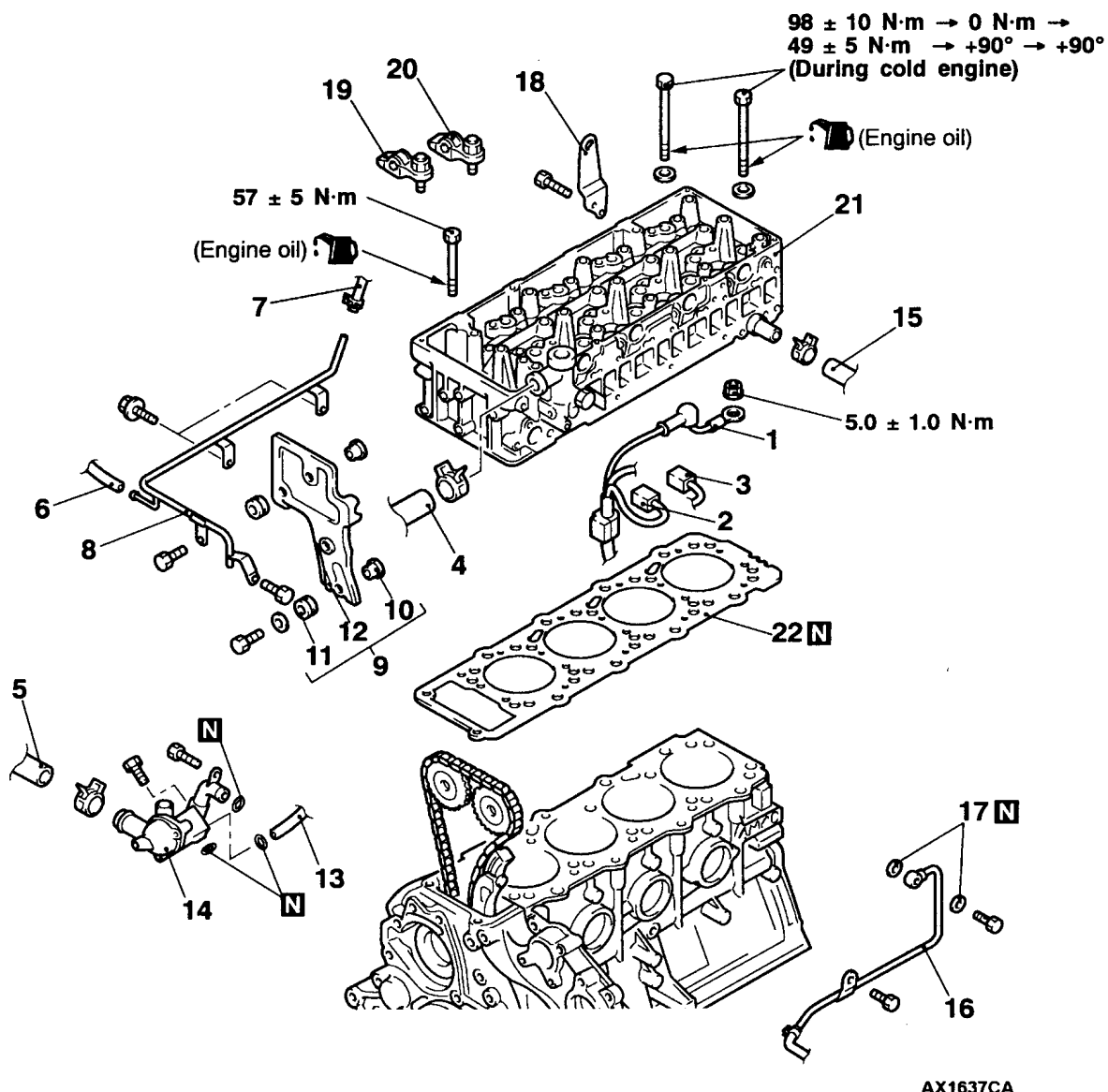


CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Drain and Refill
(Refer to GROUP 14 – On-vehicle Service.)
- Engine Oil Check and Refill
(Refer to GROUP 12 – On-vehicle Service.)
<Post-installation operation>
- Fuel Line Air-bleeding
(Refer to GROUP 13C – On-vehicle Service.)
<Post-installation operation>
- Drive Belt Tension Check and Adjustment
(Refer to P.11C-5.)<Post-installation operation>
- Camshaft Removal and Installation
(Refer to P.11C-20.)
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Intake Manifold Removal and Installation
(Refer to GROUP15.)
- Turbocharger Removal and Installation
(Refer to GROUP15.)
- Exhaust Manifold Removal and Installation
(Refer to GROUP15.)



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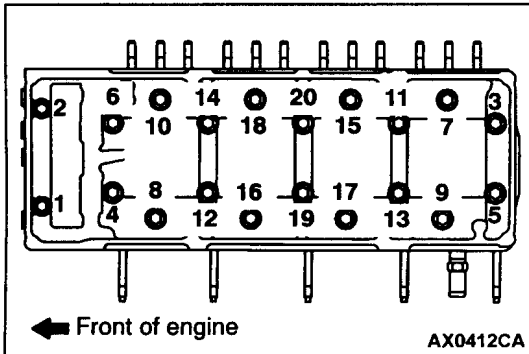
Removal steps

- | | |
|---|--|
| <p>1. Glow plug connector</p> <p>2. Engine coolant temperature gauge unit connector</p> <p>3. Engine coolant temperature sensor connector</p> <p>• Drive belt (Refer to P.11C-17.)</p> <p>4. Radiator upper hose connection</p> <p>5. Radiator lower hose connection</p> <p>6. Free-wheeling hub solenoid valve vacuum hose connection</p> <p>7. Brake booster vacuum hose connection</p> <p><R.H. drive vehicles without ABS></p> <p>8. Vacuum pipe</p> <p>9. Timing gear case cover assembly</p> <p>10. Insulator collar</p> <p>11. Insulator</p> | <p>12. Timing gear case cover</p> <p>• Alternator brace (Refer to GROUP 16.)</p> <p>13. Heater return pipe connection</p> <p>14. Bypass pipe, thermostat case and cover assembly</p> <p>15. Heater hose connection</p> <p>16. Fuel return pipe connection</p> <p>17. Fuel return pipe gasket</p> <p>18. Engine hanger</p> <p>19. Short rocker, adjusting screw and lock nut assembly</p> <p>20. Long rocker, adjusting screw and lock nut assembly</p> <p>21. Cylinder head assembly</p> <p>22. Cylinder head gasket</p> |
|---|--|

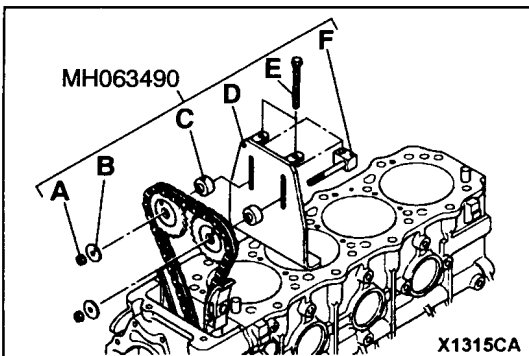


REMOVAL SERVICE POINTS**◀A▶ RADIATOR UPPER HOSE /RADIATOR LOWER HOSE DISCONNECTION**

Align the mating marks on the radiator hose and the hose clamp, and then disconnect the hose.

**◀B▶ CYLINDER HEAD ASSEMBLY REMOVAL**

1. Loosen the cylinder head bolts in the shown sequence progressively, and then remove the cylinder head bolts.
2. Lift the cylinder head assembly straight without removing the timing chain from the camshaft sprocket.



3. After the cylinder head assembly has been removed, use the special tool to hold the camshaft sprocket to prevent the timing chain from sliding off.

Special tool MH063490: Camshaft sprocket holder kit components

- A : Two nuts
- B : Two washers
- C : Two spacers
- D : One adjust plate
- E : Two bolts
- F : Two nuts

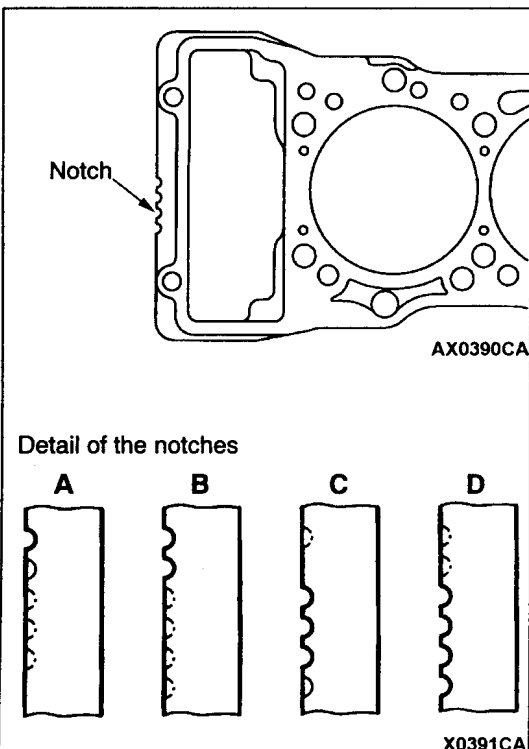
INSTALLATION SERVICE POINTS**▶A◀ CYLINDER HEAD GASKET INSTALLATION**

To replace the cylinder head gasket only, select a gasket of correct specification according to the table below.

Notch specification	Part number
A(Thickness after tightening the bolts 0.70 mm)	ME204037
B(Thickness after tightening the bolts 0.75 mm)	ME204038
C(Thickness after tightening the bolts 0.80 mm)	ME204039
D(Thickness after tightening the bolts 0.85 mm)	ME204040

Caution

The thickness of the original cylinder head gasket is selected according to the protrusion amount of the piston. Therefore, if the piston or the connecting rod is replaced, the protrusion amount may be changed. Always select a correct gasket by measuring the protrusion amount. (For details, refer to the Engine Workshop Manual.)

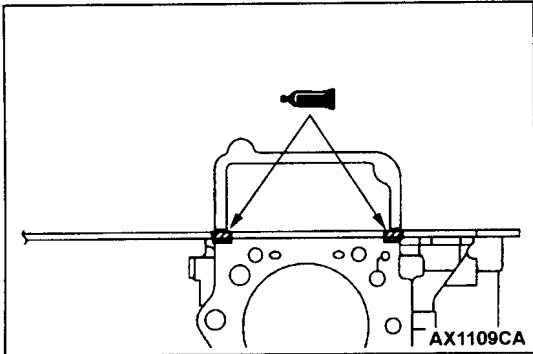


►B◄ CYLINDER HEAD ASSEMBLY INSTALLATION

1. Select a cylinder head gasket of correct specification.
2. Clean the cylinder head assembly, the timing gear case, and the crankcase assembly mating surfaces with a scraper or a wire brush.

Caution

Do not allow foreign material to enter the engine coolant or oil passages and the cylinder.



3. Apply the specified sealant to the upper side of the mating surface between the timing gear case and the crankcase assembly.

Specified sealant: 3M ATD Part No.8660 or equivalent

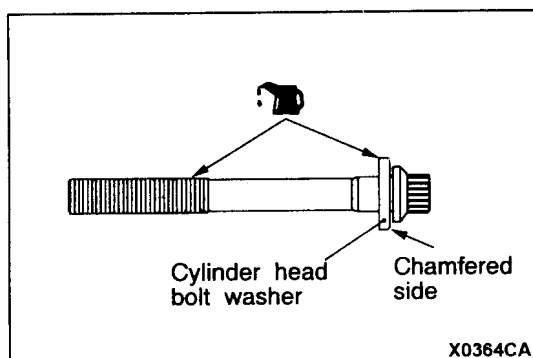
4. Immediately after applying the sealant, use the cylinder head gasket to install the cylinder head assembly to the crankcase.

Caution

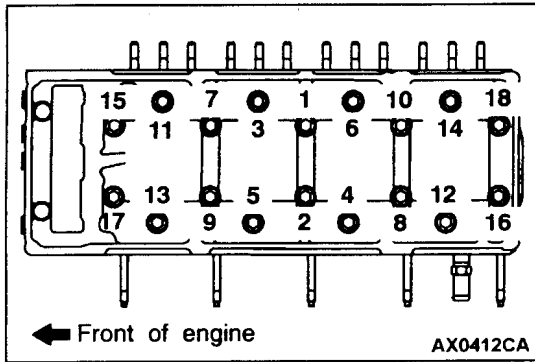
- (1) When installing the cylinder head, be careful not to disturb the sealant.
 - (2) Whenever the cylinder head bolts are loosened after the cylinder head is installed, always apply the sealant again.
 - (3) After the cylinder head is installed, wait for at least one hour, and then start the engine.
5. The cylinder head bolt can be reused three times. Before installing the bolt, mark the bolt head by a punch to indicate how many times the bolt is used.

Caution

If three marks have been already stamped, the bolt can't be reused and must be replaced with a new one.



6. Install the cylinder head bolt washer to the cylinder head bolt so that the washer chamfered side faces as shown.
7. Apply a small amount of engine oil to the cylinder head bolt thread and the washer.



8. Tighten the cylinder head bolts according to the following procedure (angle-tightening procedure).

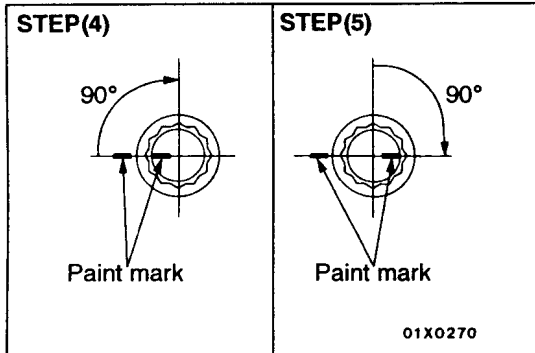
- (1) Tighten the cylinder head bolts in the shown sequence to 98 ± 10 N·m.

Bolt size: Nominal diameter×length mm

Except 3, 6, 11, 14: 12×118

3, 6, 11, 14: 12×133

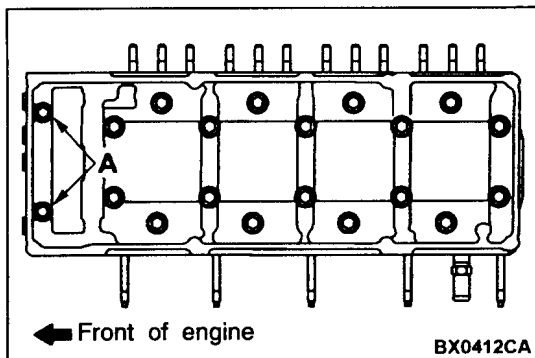
- (2) Loosen the cylinder head bolts completely in the reverse of the shown sequence.
- (3) Tighten the cylinder head bolts in the shown order to 49 ± 5 N·m.



- (4) Mark the cylinder head bolts and the cylinder head with paint, and then tighten the bolts in the shown sequence to 90° .
- (5) Tighten the bolts in the shown sequence to additional 90° , and check that the paint marks on the cylinder head bolts are flush with the paint marks on the cylinder head.

Caution

- 1) If the tightening angle is less than 90° , the bolt is loose.
- 2) If the tightening angle is more than 90° , loosen the bolt and repeat the procedure from step 2.



- (6) Apply a small amount of engine oil to the thread and the flange of bolts A, and tighten them to A to 57 ± 5 N·m.

►C◀ BYPASS PIPE, THERMOSTAT CASE AND COVER ASSEMBLY/HEATER RETURN PIPE INSTALLATION

Install the O-rings into the pipes and the thermostat case grooves, apply water to the outer circumference of the O-ring and the inside surface of the pipe, and then press in the O-rings.

Caution

Never get engine oil or grease on the O-rings.

**►D◄ RADIATOR LOWER HOSE/RADIATOR UPPER
HOSE CONNECTION**

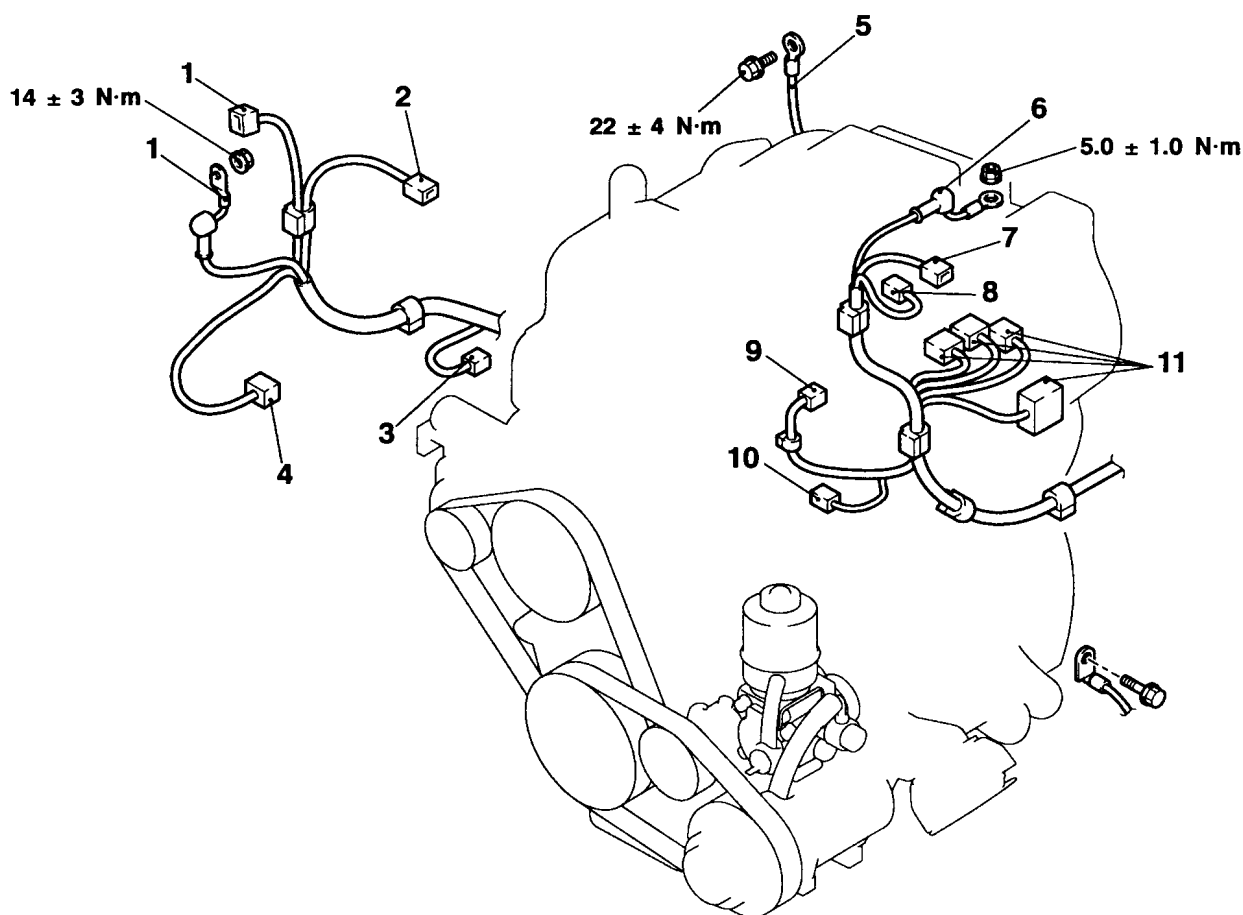
1. Insert the hose up to the convex part of the thermostat cover and water outlet pipe.
2. Align the mating marks on the radiator hose and the hose clamp, and then install the hose.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Drain and Refill
(Refer to GROUP 14 – On-vehicle Service.)
- Under Cover and Skid Plate Removal and Installation
- Engine Oil Draining and Refilling
(Refer to GROUP 12 – On-vehicle Service.)
- Fuel Line Air-bleeding
(Refer to GROUP 13C – On-vehicle Service.)
- A/C Compressor Drive Belt Tension Check and Adjustment<Vehicles with A/C>
(Refer to P.11C-7.)<Post-installation operation>
- Hood Removal and Installation(Refer to GROUP 42.)
- Engine Cover Removal and Installation
(Refer to P.11C-23.)
- Fuel Filter Removal and Installation
(Refer to GROUP 13D.)
- Air Cleaner Removal and Installation
(Refer to GROUP 15.)
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Radiator Removal and Installation
(Refer to GROUP 14.)



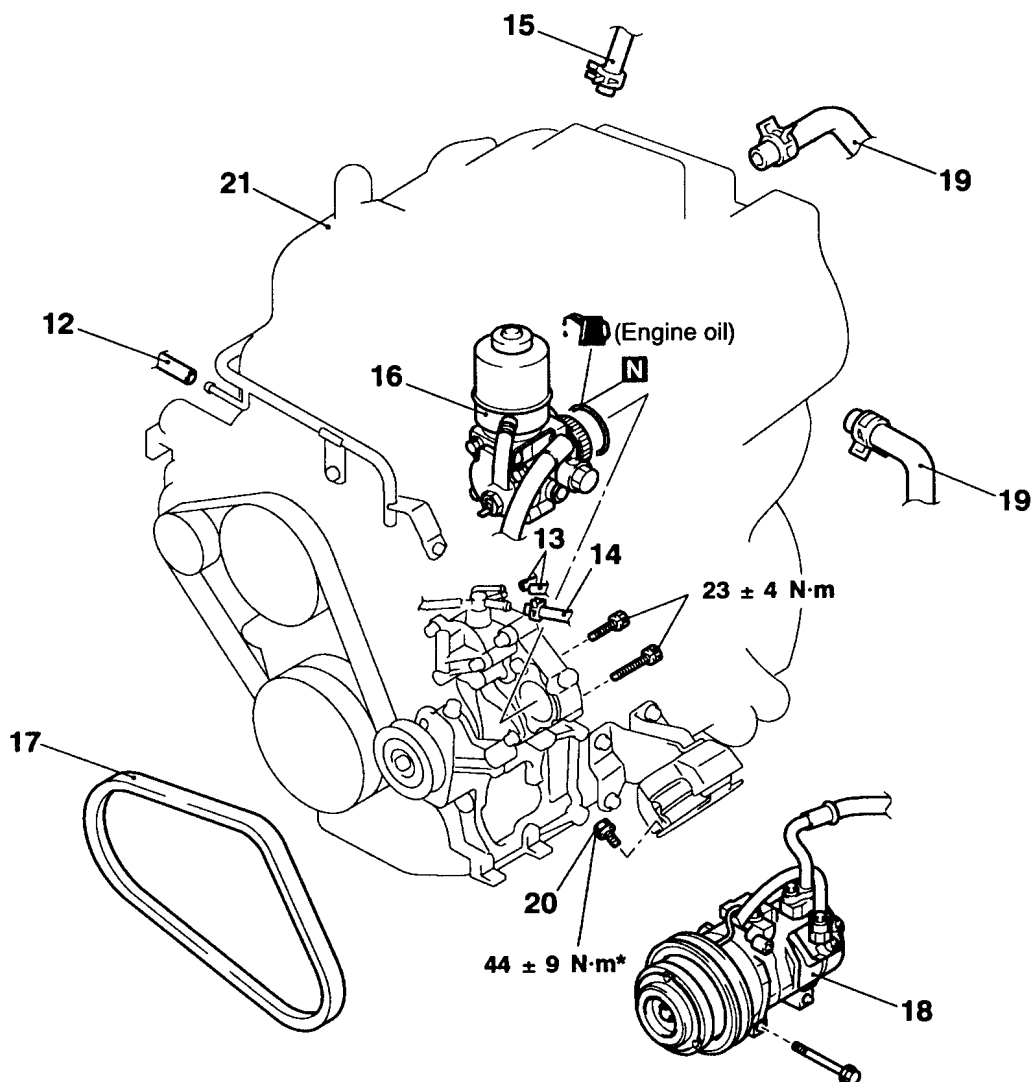
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Removal steps

- Intercooler air pipe
(Refer to GROUP 15 – Intercooler.)
- 1. Alternator connector
- 2. Oil pressure switch connector
- 3. Engine oil level sensor connector
- 4. Free-wheeling hub engage switch connector
- 5. Earth cable connection
- EGR valve and EGR pipe assembly
(Refer to GROUP 17 – EGR Valve.)
- 6. Glow plug connector
- 7. Boost air temperature sensor connector
- 8. Engine coolant temperature gauge unit connector
- 9. Power steering oil pressure switch connector
- 10. A/C compressor connector
<Vehicles with A/C>
- 11. Injection pump connector

Caution

*: indicates parts which should be temporarily tightened, and then fully tightened with the engine weight applied on the vehicle body.



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12. Free-wheeling hub solenoid valve vacuum hose connection
 13. Vacuum hose connection
 14. Brake booster vacuum hose connection
 <L.H. drive vehicles without ABS>
 15. Brake booster vacuum hose connection
 <R.H. drive vehicles without ABS>
 16. Power steering oil pump assembly
 17. A/C compressor drive belt
 <Vehicles with A/C>

◀C▶

18. A/C compressor
 <Vehicles with A/C>
 19. Heater hose connection
 • Glow plug relay and solenoid valve assembly
 • Transmission assembly
 (M/T: Refer to GROUP 22.)
 (A/T: Refer to GROUP 23.)
 20. Engine mount insulator mounting bolt
 21. Engine assembly

◀D▶ ▶A▶

◀A▶
 ▶B▶

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

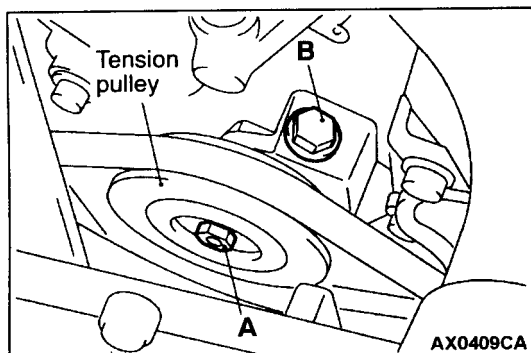
1. Remove the power steering oil pump assembly from the timing gear case with its hoses still attached.
2. Suspend the power steering oil pump with a cord out of the way.

◀B▶ A/C COMPRESSOR DRIVE BELT REMOVAL

1. Loosen the tension pulley securing bolt A.
2. Loosen the adjusting bolt B to remove the belt.

Caution

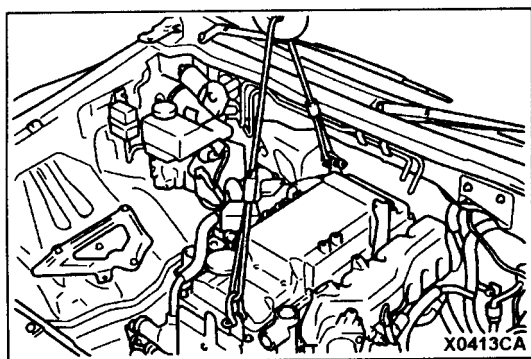
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

**◀C▶ A/C COMPRESSOR REMOVAL**

1. Remove the A/C compressor from the bracket with its refrigerant hoses still attached.
2. Suspend the A/C compressor with a cord out of the way.

◀D▶ ENGINE ASSEMBLY REMOVAL

1. Make sure that all the cables, hoses and harness connectors are disconnected.
2. Use a chain block to support and lift the engine assembly carefully.

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

Lower the engine assembly into the engine compartment, being careful not to pinch the cables, hoses or harness connectors.