

ENGINE

<4G6-MPI>

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GENERAL

OUTLINE OF CHANGES

The following service procedures have been established in line with the addition of vehicles with 4G63-MPI engine.

GENERAL INFORMATION

Items		4G63	
Total displacement mL		1,997	
Bore × Stroke mm		85.0 × 88.0	
Compression ratio		10.0	
Combustion chamber		Pentroof type	
Camshaft arrangement		SOHC	
Number of valve	Intake	8	
	Exhaust	8	
Valve timing	Intake	Opening	BTDC 11°
		Closing	ABDC 53°
	Exhaust	Opening	BBDC 63°
		Closing	ATDC 21°
Fuel system		Electronically controlled multipoint fuel injection	
Rocker arm		Roller type	
Auto-lash adjuster		Equipped	

SERVICE SPECIFICATIONS

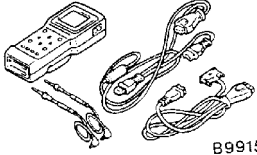
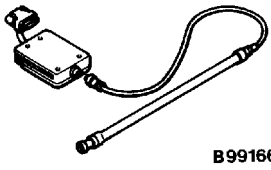
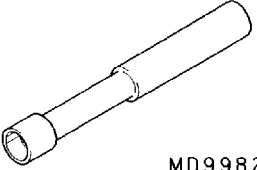
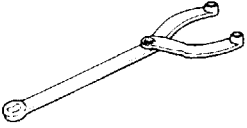
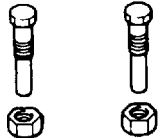
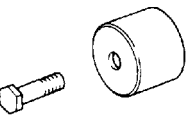
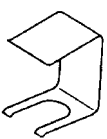
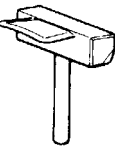
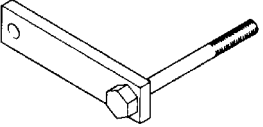
Items		Standard value	Limit
Alternator drive belt checked	Vibration frequency Hz	177 - 232	-
	Tension N	343 - 588	-
	Deflection (Reference value) mm	6.7 - 9.8	-
When adjusting the alternator drive belt	Vibration frequency Hz	201 - 222	-
	Tension N	441 - 539	-
	Deflection (Reference value) mm	7.2 - 8.4	-
When replacing the alternator drive belt	Vibration frequency Hz	241 - 276	-
	Tension N	637 - 833	-
	Deflection (Reference value) mm	5.0 - 6.4	-
Power steering oil pump and A/C compressor drive belt tension (When checked)	Vibration frequency Hz	108 - 132	-
	Tension N	392 - 588	-
	Deflection (Reference value) mm	11.7 - 15.3	-

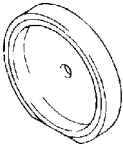
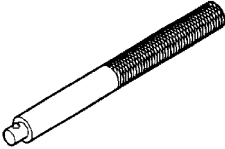
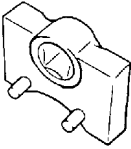
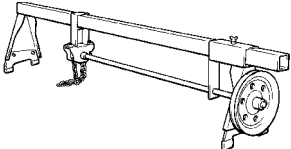
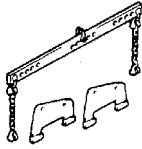
Items		Standard value	Limit
Power steering oil pump and A/C compressor drive belt tension (When adjusted)	Vibration frequency Hz	114 - 126	-
	Tension N	441 - 539	-
	Deflection (Reference value) mm	12.5 - 14.3	-
Power steering oil pump and A/C compressor drive belt tension (When replaced)	Vibration frequency Hz	137 - 157	-
	Tension N	637 - 834	-
	Deflection (Reference value) mm	8.8 - 11.0	-
Basic ignition timing		5° BTDC ± 3°	-
Ignition timing		Approx.10° BTDC	-
Idle speed r/min		750 ± 100	-
CO contents %		0.5 or less	-
HC contents ppm		100 or less	-
Compression pressure kPa-r/min		1,400	Min. 1,060
Compression pressure difference of all cylinder kPa		-	Max. 100
Intake manifold vacuum kPa		-	Min. 69
Cylinder head bolt shank length mm		-	99.4
Auto-tensioner push rod movement mm		Within 1	-
Timing belt tension torque Nm (Reference value)		3.5	-
Auto-tensioner rod protrusion amount mm		3.8 - 4.5	-
Timing belt B tension mm		5 - 7	-

SEALANTS

Items	Specified sealants	Remarks
Rocker cover and cylinder head Semi-circular packing	3M ATD Part No.8660 or equivalent	-
Oil pan Thermostat case	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Flywheel or drive plate bolt	3M Stud Locking 4170 or equivalent	-

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> ● Checking the ignition timing ● Checking the idle speed ● Erasing diagnosis code ● Measuring the drive belt tension
 B991668	MB991668	Belt tension meter set	Measuring the drive belt tension (used together with the MUT-II)
 MD998299	MD998299	MAS screwdriver	Adjustment of the mixture adjusting screw <Vehicles without catalytic converter>
	MB990767	End yoke holder	<ul style="list-style-type: none"> ● Holding the camshaft sprocket ● Holding the crankshaft sprocket
	MD998719 or MD998754	Crankshaft pulley holder pin	<ul style="list-style-type: none"> ● Holding the camshaft sprocket ● Holding the crankshaft sprocket
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
	MD998443	Auto-lash adjuster holder	Supporting of auto-lash adjuster
	MD998727	Oil pan remover	Removal of oil pan
	MD998781	Flywheel stopper	Securing the flywheel or drive plate

Tool	Number	Name	Use
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	Press-in of the crankshaft rear oil seal
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
 B991453	MB991453	Engine hanger assembly	

ON-VEHICLE SERVICE

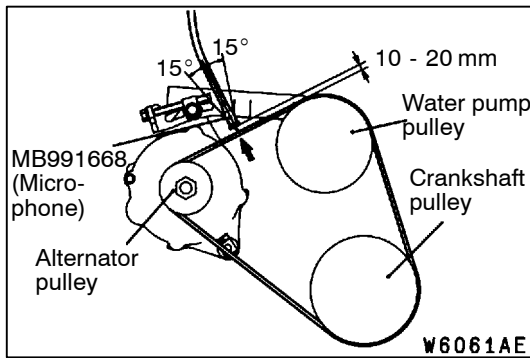
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Check the drive belt tension in the following procedure.

Standard value:

Vibration frequency Hz	177 - 232
Tension N	343 - 588
Deflection (Reference value) mm	6.7 - 9.8

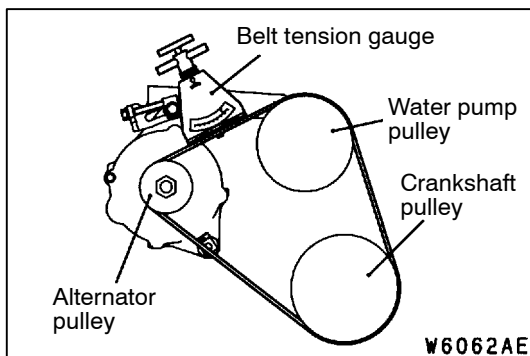


<When using the MUT-II>

1. Connect the special tool (belt tension meter set) to the MUT-II.
2. Connect the MUT-II to the diagnosis connector.
3. Turn the ignition switch to ON and select "Belt Tension Measurement" from the menu screen.
4. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), about 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.

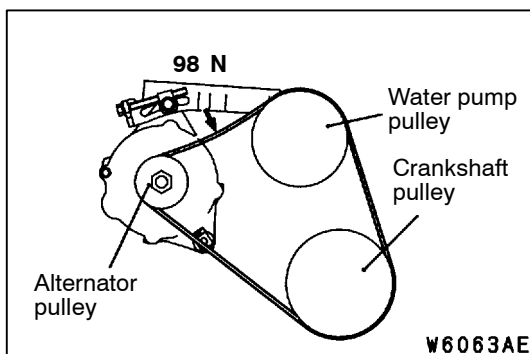
Caution

- (1) The temperature of the surface of the belt should be as close as possible to normal temperature.
- (2) Do not let any contaminants such as water or oil 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.



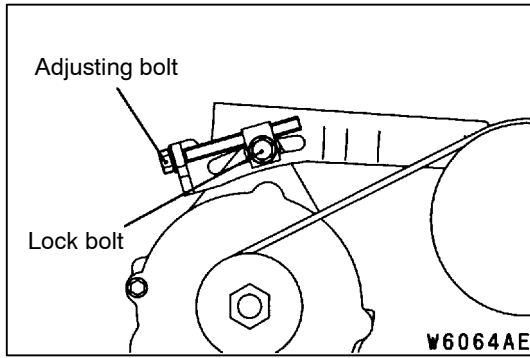
<When using a tension gauge>

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



<Belt deflection check>

Apply 98 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.



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the alternator pivot bolt.
2. Loosen the lock bolt.
3. Use the adjusting bolt to adjust the belt tension and belt deflection to the standard values.

Standard value:

Items	When adjusting	When replacing
Vibration frequency Hz	201 - 222	241 - 276
Tension N	441 - 539	637 - 833
Deflection (Reference value) mm	7.2 - 8.4	5.0 - 6.4

4. Tighten the nut of the alternator pivot bolt.

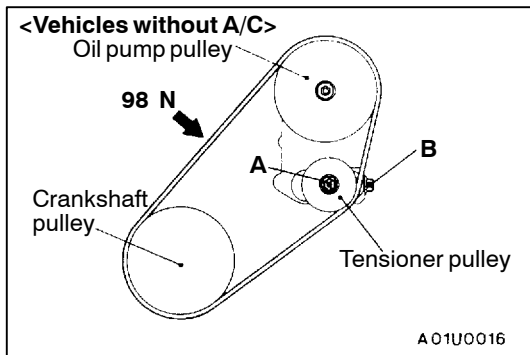
Tightening torque: 49 Nm

5. Tighten the lock bolt.

Tightening torque: 22 Nm

6. Tighten the adjusting bolt.

Tightening torque: 5 Nm

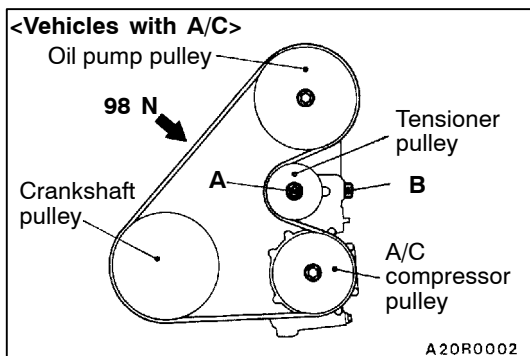


POWER STEERING OIL PUMP AND AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

1. Check if the belt tension is within the standard value using one of the methods below.

Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	108 - 132	114 - 126	137 - 157
Tension N	392 - 588	441 - 539	637 - 834
Deflection (Reference value) mm	11.7 - 15.3	12.5 - 14.3	8.8 - 11.0



<When measuring the vibration frequency>

With your finger tip lightly tap the centre of the belt between the pulleys in the location shown by the arrow in the illustration and then measure the belt vibration frequency.

NOTE

Refer to P.11C-7 for information regarding the vibration frequency measurement method using MUT-II.

<When measuring the tension>

Use a belt tension gauge to measure the belt tension.

<When measuring the deflection>

Apply 98 N of pressure against the location between the pulleys shown by the arrow in the illustration and then measure the deflection.

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

Tightening torque: 25 Nm

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

Caution

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

IGNITION TIMING CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.
3. Set up a timing light.
4. Start the engine and run at idle.
5. Check that engine idle speed is within the standard value.

Standard value: 750 ± 100 r/min

6. Select No.17 of the MUT-II Actuator test.
7. Check that basic ignition timing is within the standard value.

Standard value: 5° BTDC±3°

8. If the basic ignition timing is outside the standard value, inspect the MPI 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. 10°BTDC**NOTE**

1. Ignition timing is variable within about ± 7°, even under normal operating.
2. And it is automatically further advanced by about 5° from standard value at higher altitudes.

IDLE SPEED CHECK

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

Standard value: 5° BTDC±3°

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

Standard value: 750 ± 100 r/min

NOTE

The idle speed is controlled automatically by the idle speed control (ISC) system.

6. If the idle speed is outside the standard value, inspect the MPI 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 "LOCK" (OFF) position and connect the MUT-II to the diagnosis connector.
3. Check that the basic ignition timing is within the standard value.

Standard value: 5° BTDC±3°

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

Standard value

CO contents: 0.5% or less

HC contents: 100 ppm or less

7. If there is a deviation from the standard value, check the following items:
 - Diagnosis output
 - Closed-loop control (When the closed-loop control is normal, the output signal of the oxygen sensor changes between 0-400 mV and 600-1,000 mV at idle.)
 - Fuel pressure
 - Injector
 - Ignition coil, spark plug cable, spark plug
 - Leak in the EGR system and in the EGR valve
 - 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. Disconnect the spark plug cables.
3. Remove all of the spark plugs.
4. Disconnect the crank angle sensor connector.

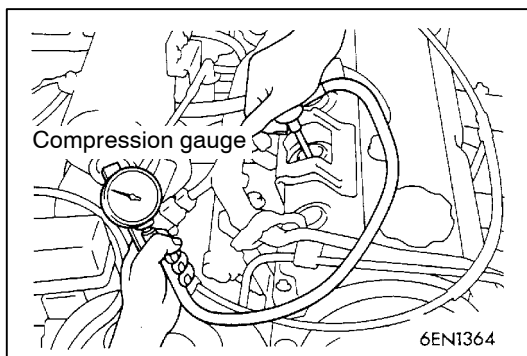
NOTE

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

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

Caution

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



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

Standard value (at engine speed of 250-400 r/min):
1,400 kPa

Limit (at engine speed of 250-400 r/min):
Min. 1,060 kPa

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

Limit: Max. 100 kPa

9. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps 7 and 8.

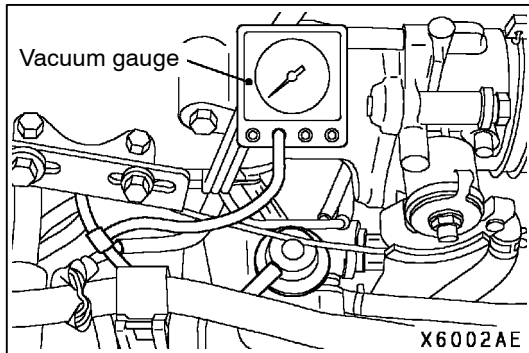
(1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.

- (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

10. Connect the crank angle sensor connector.
11. Install the spark plugs and spark plug cables.
12. 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.



MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Attach a three-way union to the vacuum hose between the fuel pressure regulator and the air intake plenum, and connect a vacuum gauge.
3. Start the engine and check that idle speed is within standard value. Then read off the vacuum gauge.

Limit: Min. 69 kPa

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) The abnormal noise which is caused by a problem with the lash adjusters is generated after the engine is started, and will vary according to the engine speed. However, this noise is not related to the actual engine load.

Because of this, if the noise does not occur immediately after the engine is started, if it does not change in accordance with the engine speed, or if it changes in accordance with the engine load, the source of the noise is not the lash adjusters.

- (2) 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.

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.

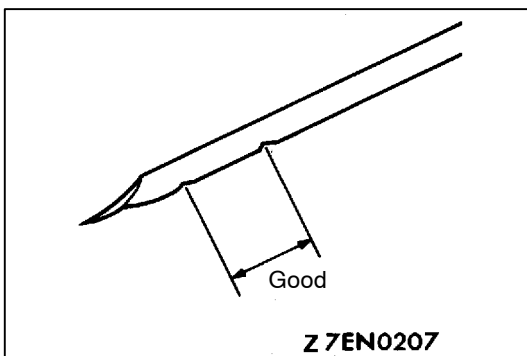
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine 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.
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>

NOTE

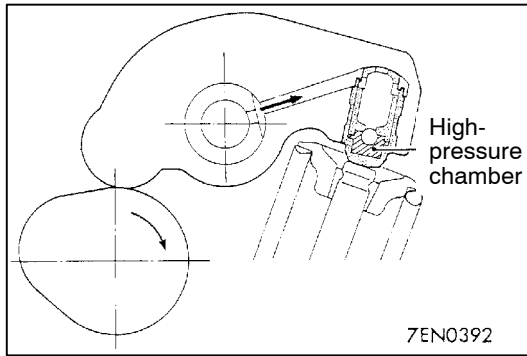
- (1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
- (2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes 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.



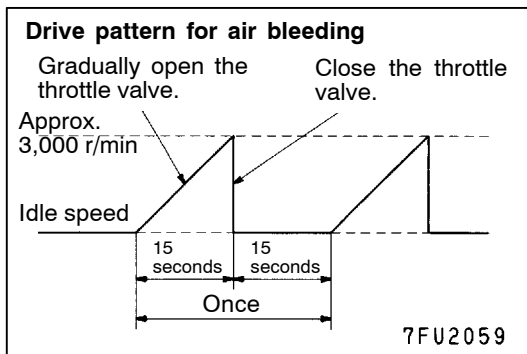
1. Check the engine oil and replenish or replace the oil if necessary.

NOTE

- (1) If there is only a 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 be 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.



- (4) 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.

CRANKSHAFT PULLEY

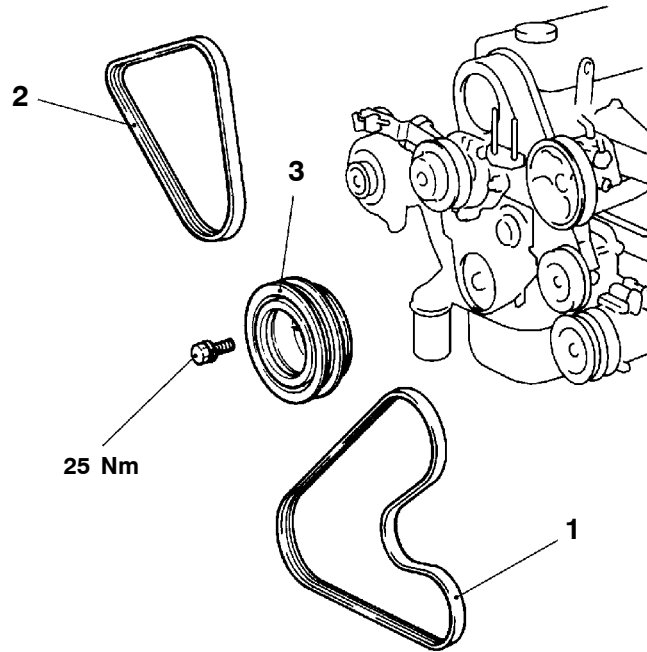
REMOVAL AND INSTALLATION

Pre-removal Operation

- Under Cover Removal

Post-installation Operation

- Drive Belt Tension Adjustment (Refer to P.11C-6.)
- Under Cover Installation



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Removal steps

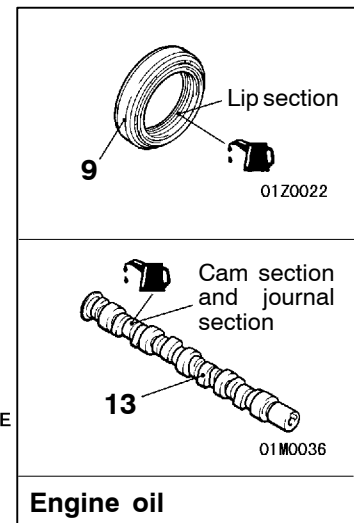
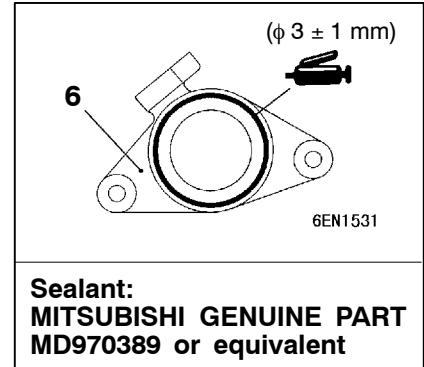
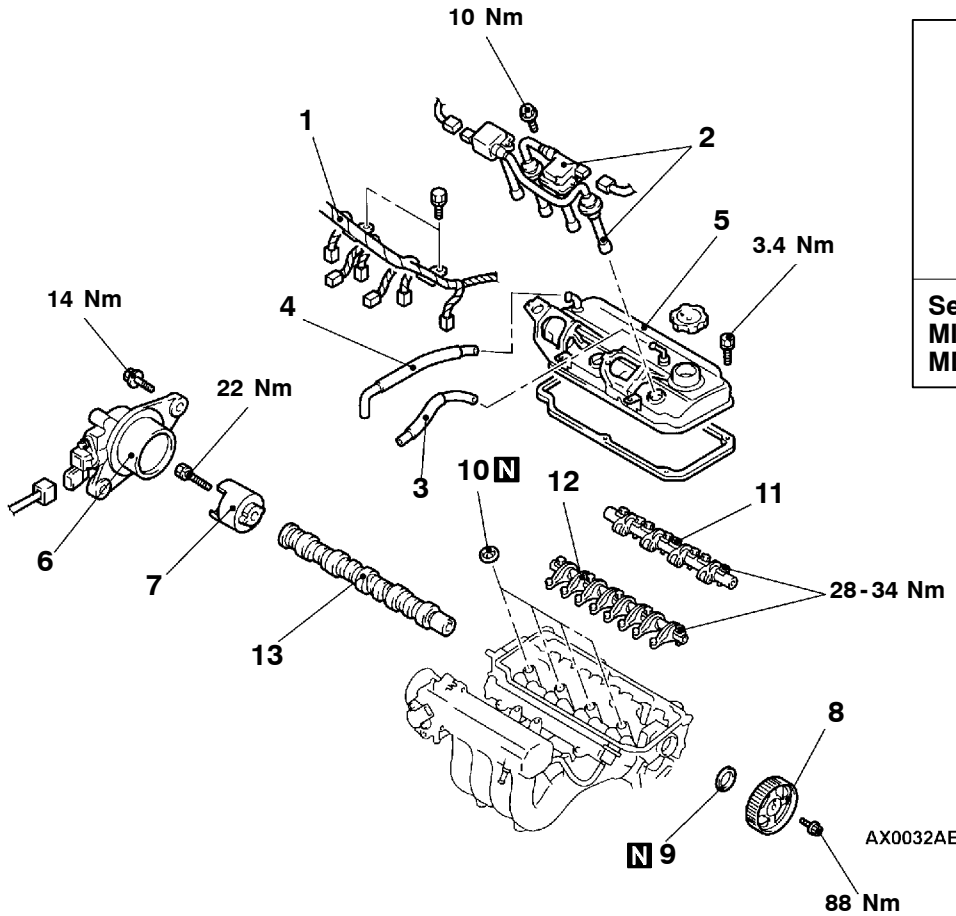
1. Drive belt (Power steering and A/C)
2. Drive belt (Alternator)
3. Crankshaft pulley

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation
- Timing Belt Removal and Installation (Refer to P.11C-27.)

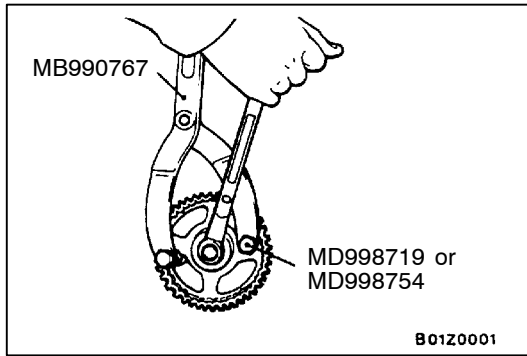
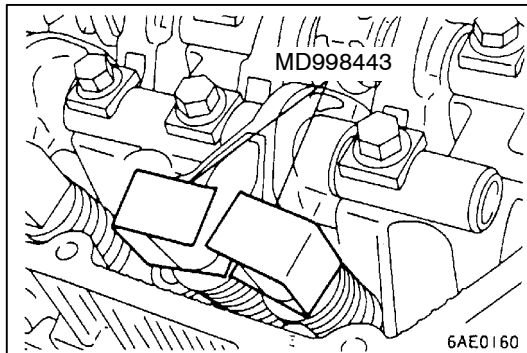


Removal steps

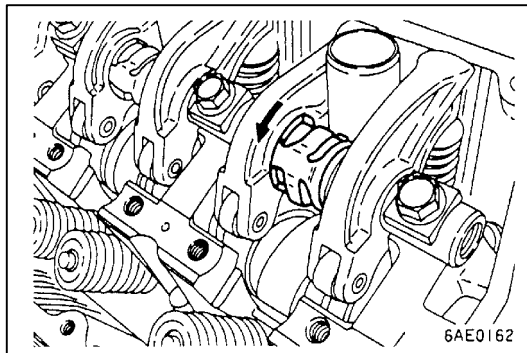
1. Control harness connection
2. Spark plug cable and ignition coil
3. PCV hose connection
4. Breather hose
5. Rocker cover
6. Camshaft position sensor support
7. Camshaft position sensing cylinder
8. Camshaft sprocket

- ▶B◀ 9. Camshaft oil seal
- ▶A◀ 10. Spark plug guide oil seal
- ▶B▶A◀ 11. Rocker arm and shaft assembly (intake side)
- ▶B▶A◀ 12. Rocker arm and shaft assembly (exhaust side)
- ▶A◀ 13. Camshaft



**REMOVAL SERVICE POINTS****◀A▶ CAMSHAFT SPROCKET REMOVAL****◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL**

Before removing the rocker arm and shaft assembly, install the special tools as shown in the illustration so that the lash adjusters will not fall out.

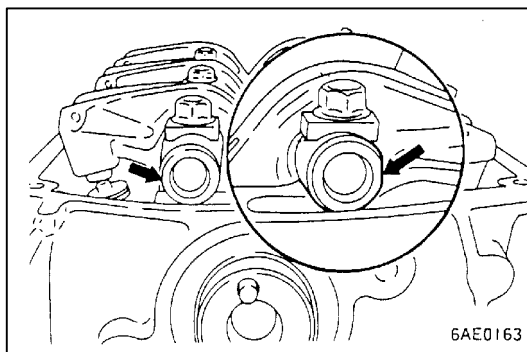
**INSTALLATION SERVICE POINTS****▶A▶ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION**

1. Temporarily tighten the rocker shaft with the bolt so that all rocker arms on the inlet valve side do not push the valves.
2. Fit the rocker shaft spring from the above and position it so that it is right angles to the plug guide.

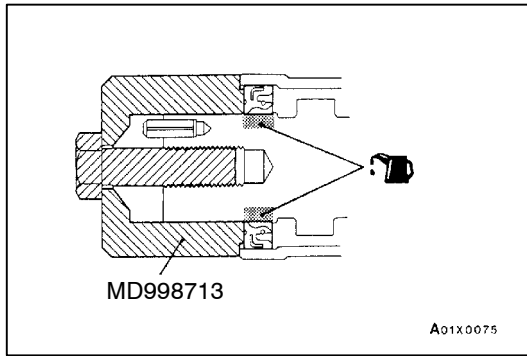
NOTE

Install the rocker shaft spring before installing the rocker arm and rocker arm shaft on the exhaust side.

3. Remove the special tool for fixing the lash adjuster.



4. Confirm that the rocker shaft notch is in the direction shown in the diagram.

**►B◄ CAMSHAFT OIL SEAL INSTALLATION**

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

►C◄ CAMSHAFT SPROCKET INSTALLATION

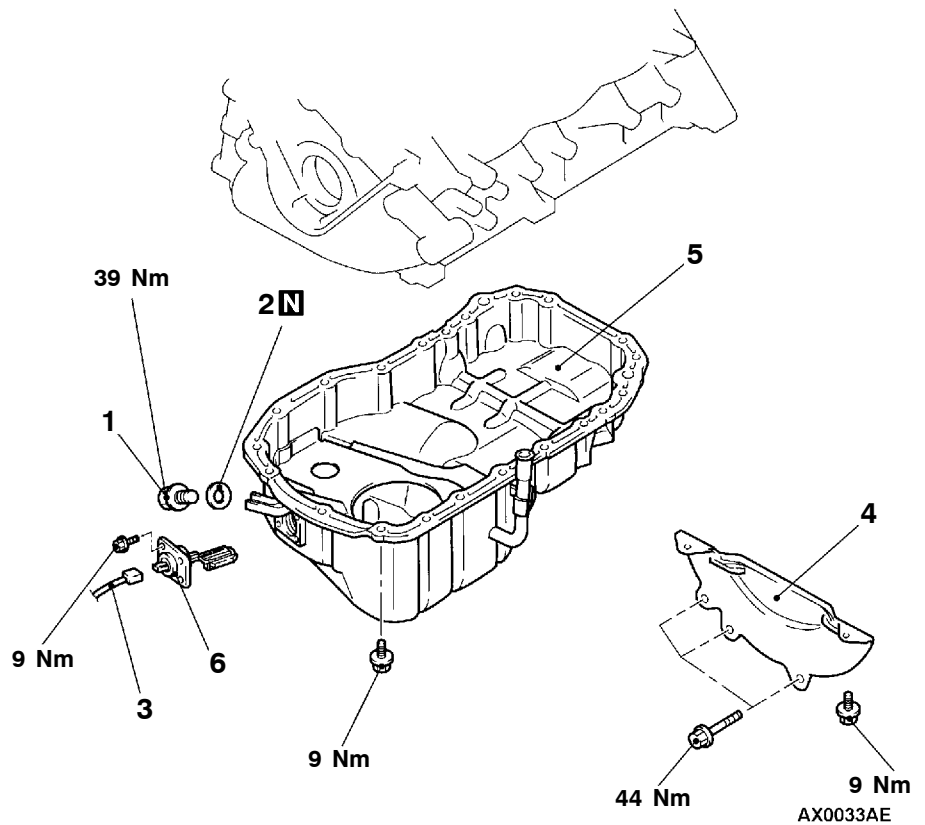
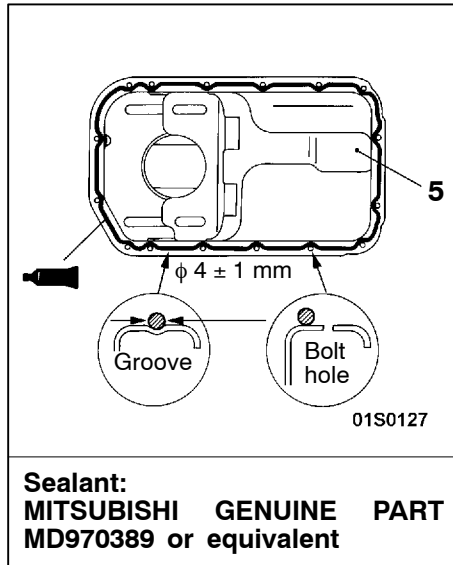
Use the special tool to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Under Cover Removal and Installation
- Engine Oil Draining and Supplying
- Oil Level Gauge Removal and Installation
- Front Exhaust Pipe Removal and Installation

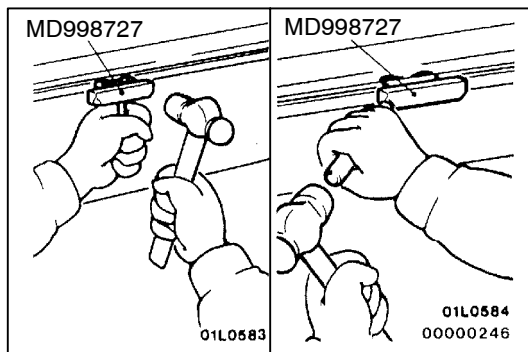


Removal steps

- ▶◀
1. Drain plug
 2. Drain plug gasket
 3. Harness connector



4. Bell housing cover
5. Oil pan
6. Oil level sensor



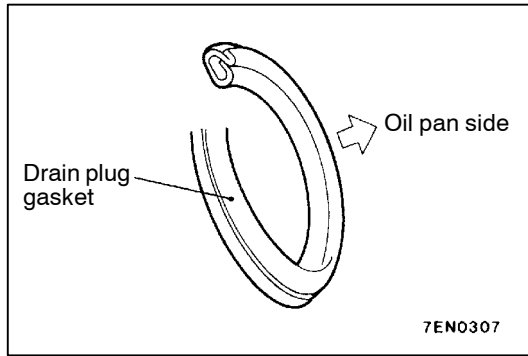
REMOVAL SERVICE POINT

◀▶ OIL PAN REMOVAL

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

Caution

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



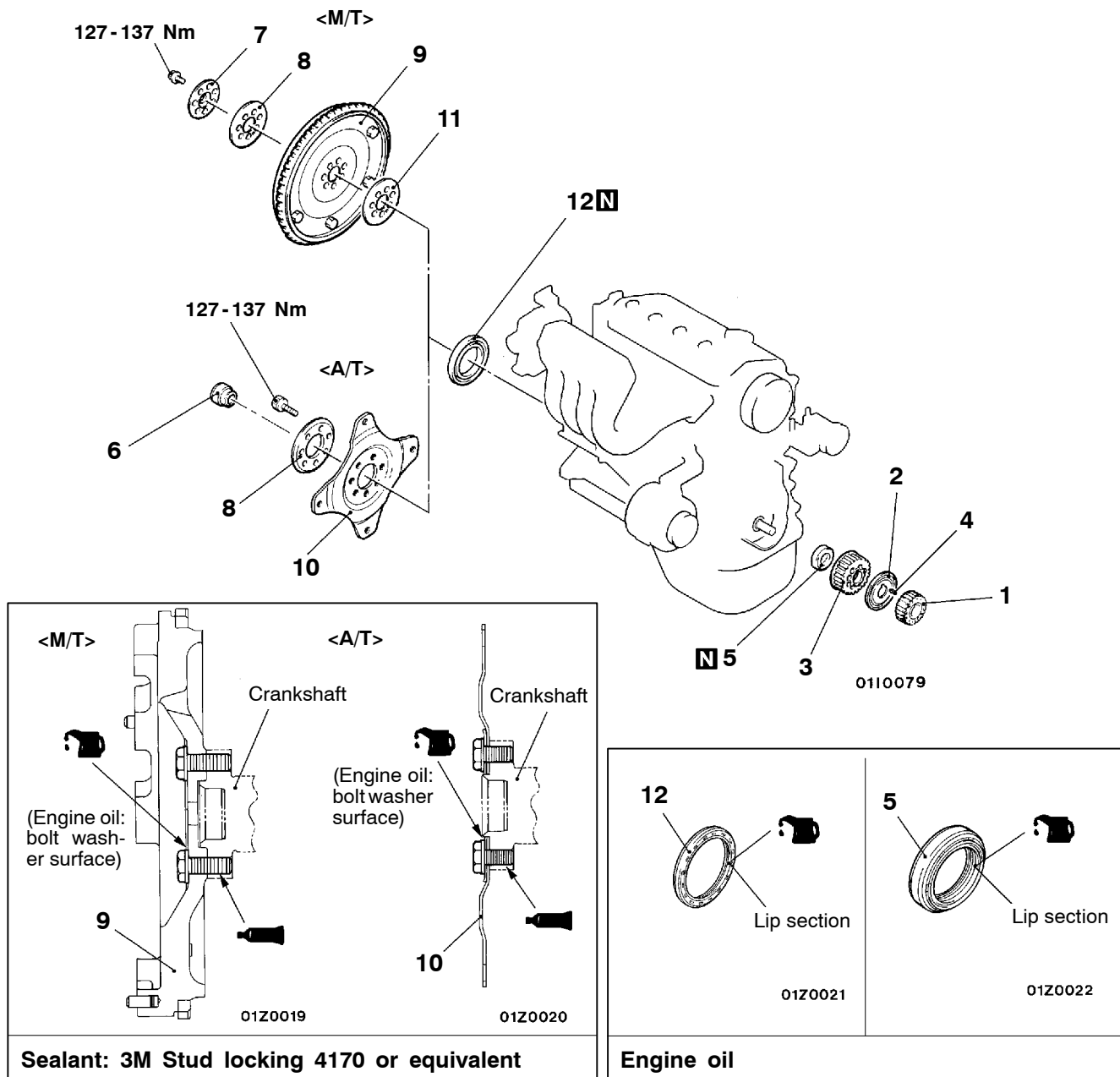
INSTALLATION SERVICE POINT

▶◀ DRAIN PLUG GASKET INSTALLATION

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

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION



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Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11C-27.)
- Timing belt B (Refer to P.11C-31.)
- Crank angle sensor (Refer to GROUP 16.)

1. Crankshaft sprocket
2. Flange
3. Crankshaft sprocket B
4. Key

▶C◀ 5. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

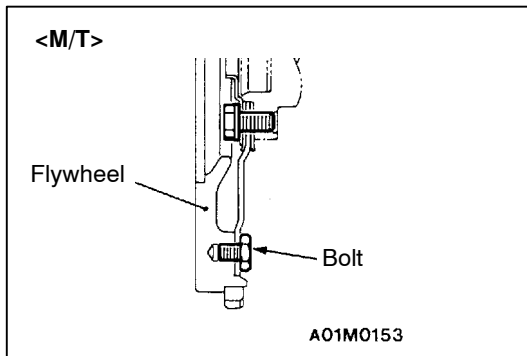
- Oil pan (Refer to P.11C-19.)
- Transmission assembly
- Clutch cover and disc <M/T>
- 6. Crankshaft bushing <A/T>

◀A▶

◀B▶

▶B◀

7. Plate <M/T>
8. Adapter plate
9. Flywheel <M/T>
10. Drive plate <A/T>
11. Adapter plate <M/T>
12. Crankshaft rear oil seal



REMOVAL SERVICE POINTS

◀A▶ TRANSMISSION ASSEMBLY REMOVAL

<M/T>:

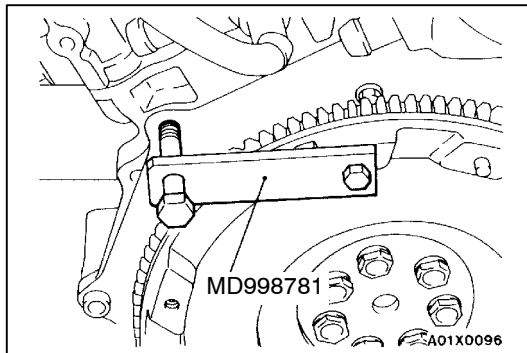
Refer to '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803) GROUP 22.

Caution

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

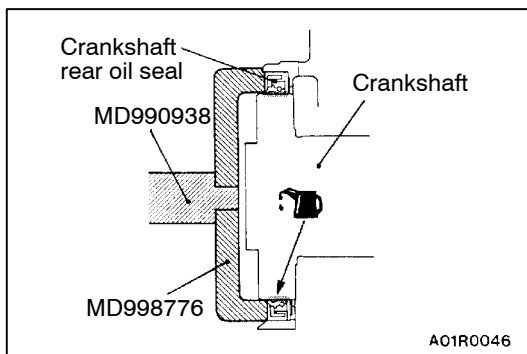
<A/T>:

Refer to '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803) GROUP 23.



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

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



INSTALLATION SERVICE POINTS

▶A▶ CRANKSHAFT REAR OIL SEAL INSTALLATION

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

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

1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel or drive plate.

2. Apply oil to the bearing surface of the flywheel or drive plate bolts.
3. Apply oil to the crankshaft thread holes.
4. Apply sealant to the threaded mounting holes.

Specified sealant: 3M Stud locking 4170 or equivalent

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

▶◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

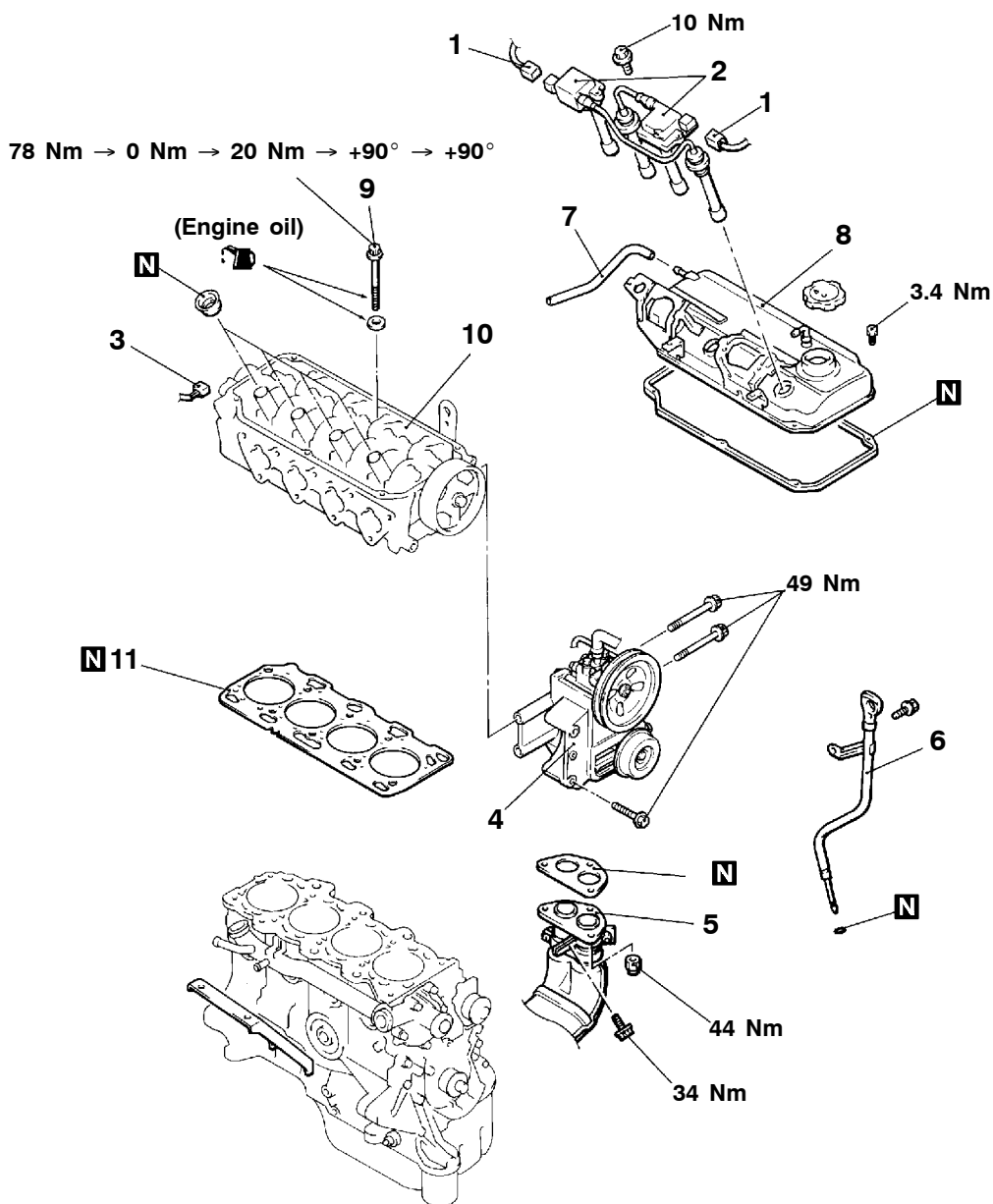
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Press-fit the oil seal unit it is flush with the oil seal case.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Fuel Discharge Prevention (Refer to GROUP 13D - On-vehicle Service.) <Pre-removal only>
- Engine Coolant Draining and Supplying
- Engine Oil Draining and Supplying
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Thermostat Case Assembly Removal and Installation (Refer to GROUP 14 - Water Hose and Pipe.)
- Timing Belt Removal and Installation (Refer to P.11C-27.)



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Removal steps

- | | |
|---|----------------------------|
| 1. Ignition coil connector | 6. Engine oil level gauge |
| 2. Ignition coil assembly | 7. Breather hose |
| 3. Camshaft position sensor connector | 8. Rocker cover |
| 4. Power steering oil pump and bracket assembly | 9. Cylinder head bolt |
| 5. Front exhaust pipe connection | 10. Cylinder head assembly |
| | 11. Cylinder head gasket |



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

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

NOTE

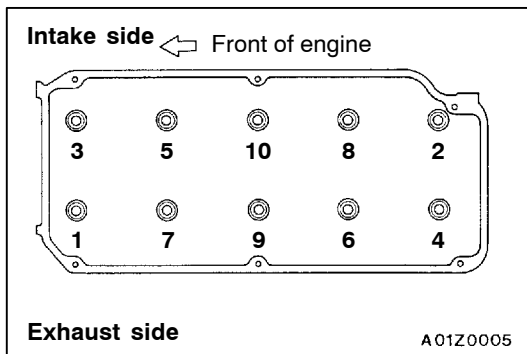
Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the cylinder head assembly, and tie it with a cord.

◀B▶ CYLINDER HEAD BOLT REMOVAL

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

Caution

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

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

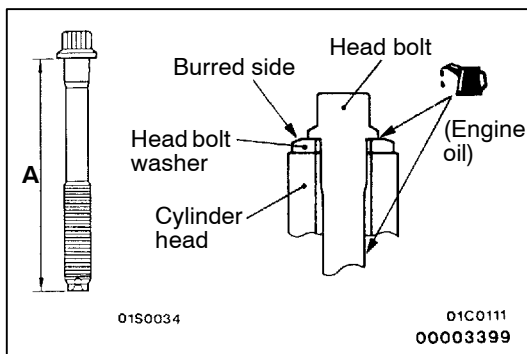
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.

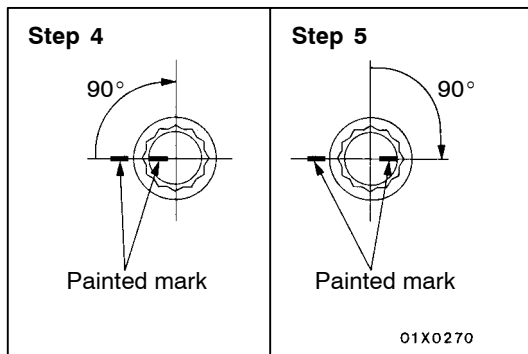
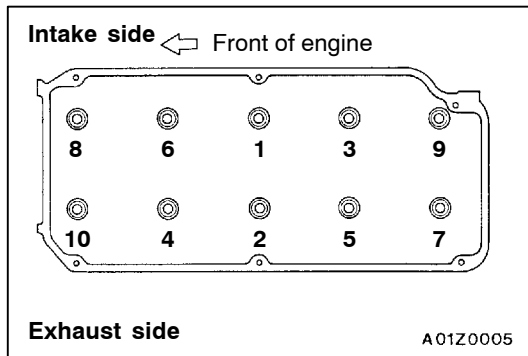
▶B▶ CYLINDER HEAD BOLT INSTALLATION

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

Limit (A): 99.4 mm

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





4. Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 78 Nm.	Carry out in the order shown in the illustration.
2	Fully loosen.	Carry out in the reverse order of that shown in the illustration.
3	Tighten to 20 Nm.	Carry out in the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
5	Tighten 90° of a turn.	In the order shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

Caution

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

►◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

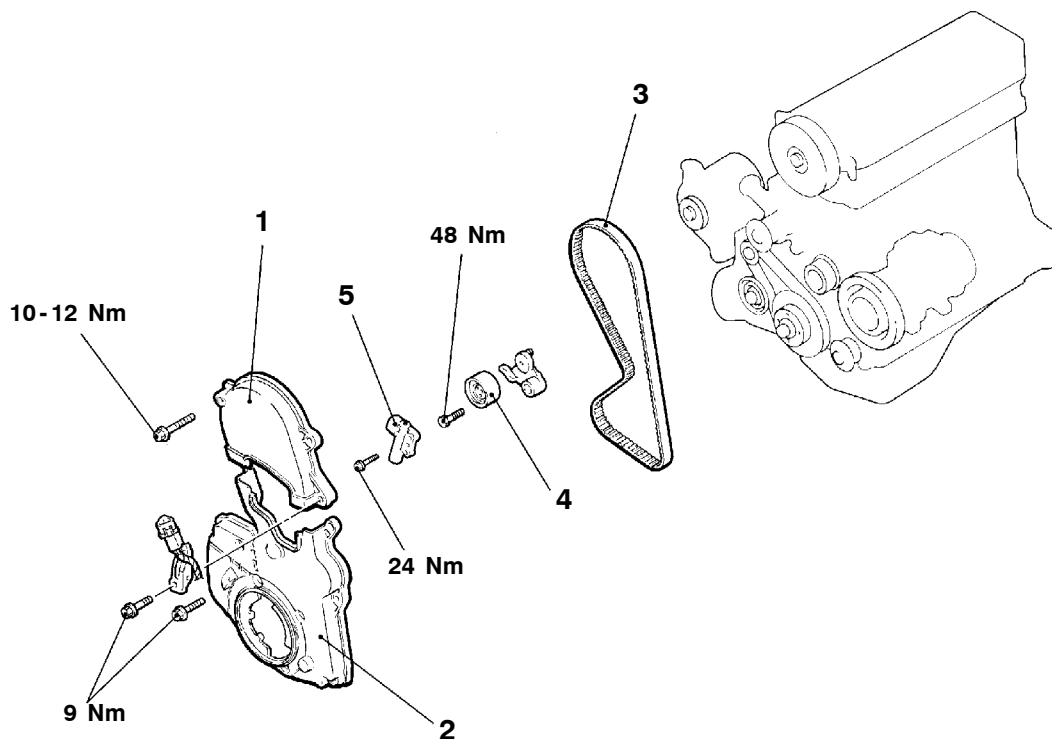
Caution

Do not let any engine oil get into the delivery pipe.

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

TIMING BELT**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

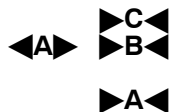
- Crankshaft Pulley Removal and Installation (Refer to P.11C-15.)
- Engine Mount Bracket Removal and Installation

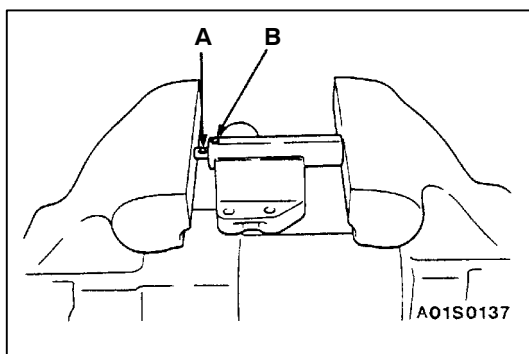
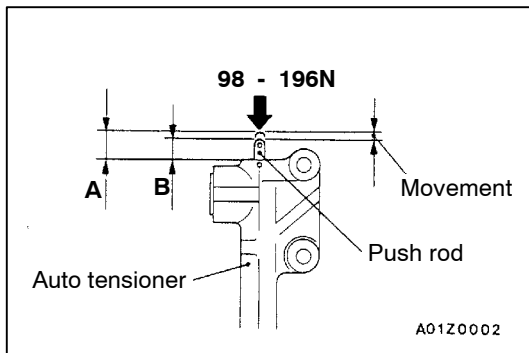
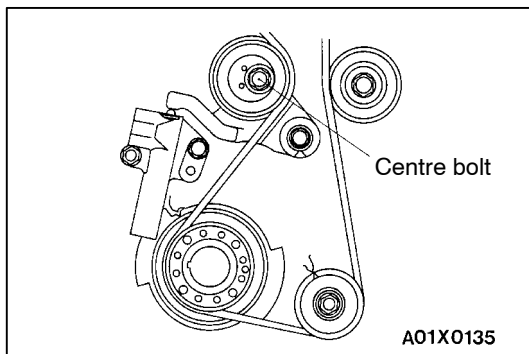
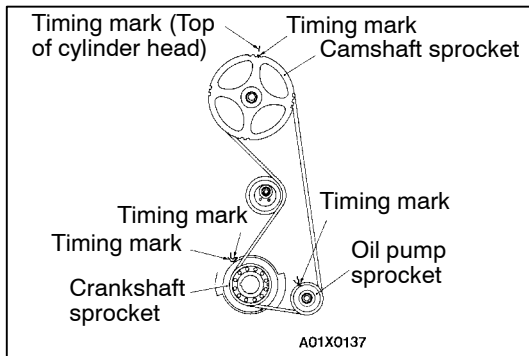


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Removal steps

1. Timing belt upper cover
2. Timing belt lower cover
- Timing belt tension adjustment
3. Timing belt
4. Tension pulley
5. Auto tensioner





REMOVAL SERVICE POINT

◀A▶ TIMING BELT REMOVAL

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

Caution

The crankshaft should always be turned only clockwise.

2. Loosen the tension pulley centre bolt.
3. Move the tension pulley to the water pump side, and then remove the timing belt.

Caution

If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.

INSTALLATION SERVICE POINTS

▶A◀ AUTO TENSIONER INSTALLATION

1. Apply 98 - 196 N force to the auto tensioner by pressing it against a metal (cylinder block, etc.), and measure the movement of the push rod.

Standard value: Within 1 mm

A: Length when it is free (not pressed)

B: Length when it is pressed

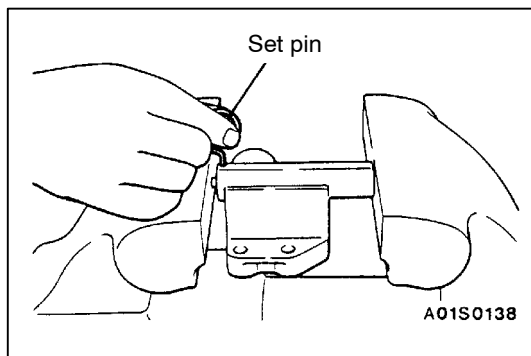
A - B: Movement

2. If it is out of the standard value, replace the auto tensioner.

3. Use a press or vice to gently compress the auto tensioner push rod until pin hole A of the push rod and pin hole B of the tensioner cylinder are aligned.

Caution

If the compression speed is too fast, the rod may become damaged, so be sure to carry out this operation slowly.

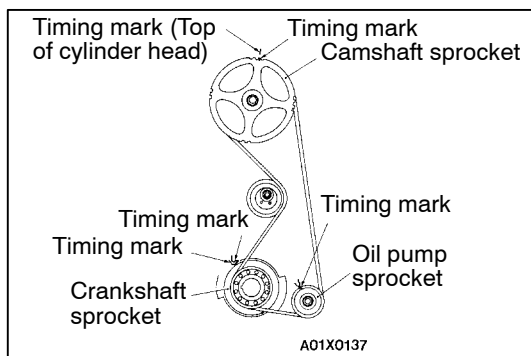


- Once the holes are aligned, insert the set pin.

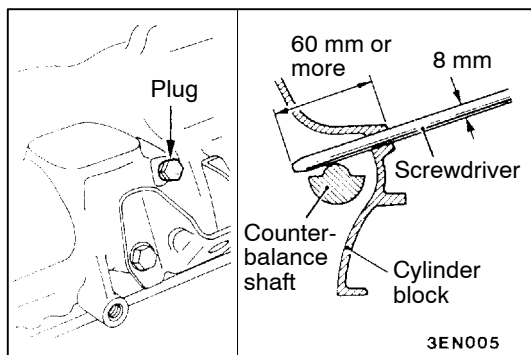
NOTE

When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.

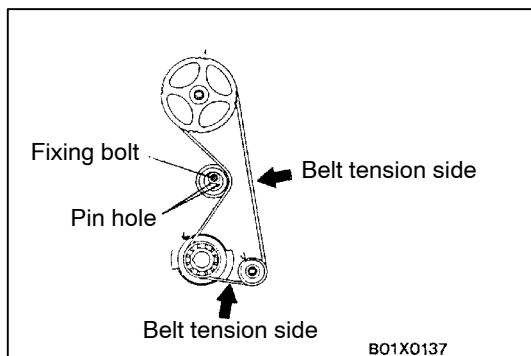
- Install the auto tensioner to the engine.

**▶B◀ TIMING BELT INSTALLATION**

- Align the timing marks on the camshaft sprocket, crankshaft sprocket and oil pump sprocket.



- After aligning the timing mark on the oil pump sprocket, remove the cylinder block plug and insert a Phillips screwdriver with a diameter of 8 mm, and check to be sure that the screwdriver goes in 60 mm or more. If the screwdriver will only go in 20 - 25 mm before striking the counterbalance shaft, turn the sprocket once, realign the timing mark and check that the screwdriver goes in 60 mm or more. The screwdriver should not be taken out until the timing belt is installed.

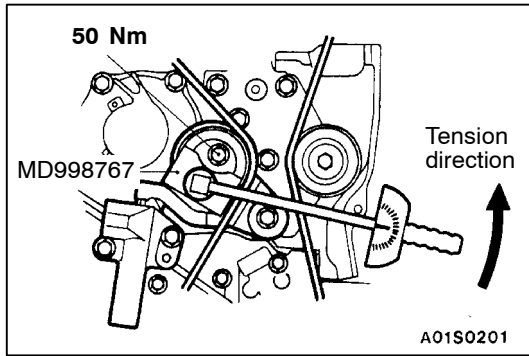


- Install the belt to the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order, so that there is no slackness in the belt tension.

Caution

If the timing belt is re-used, install so that the arrow marked on it at time of removal is pointing in the clockwise direction.

- Set the tension pulley so that the pin holes are at the top, press the tension pulley lightly against the timing belt, and then provisionally tighten the fixing bolt.
- Adjust the timing belt tension.



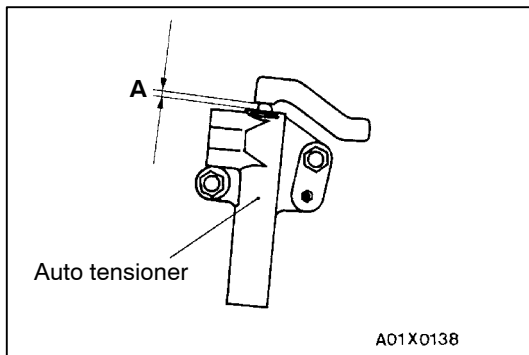
▶◀ TIMING BELT TENSION ADJUSTMENT

1. After turning the crankshaft 1/4 of a revolution in the anticlockwise direction, turn it in the clockwise direction until the timing marks are aligned.
2. Loosen the tension pulley fixing bolt, and then use the special tool and a torque wrench to tighten the fixing bolt to the specified torque while applying tension to the timing belt.

Standard value: 3.5 Nm <Timing belt tension torque>

Caution

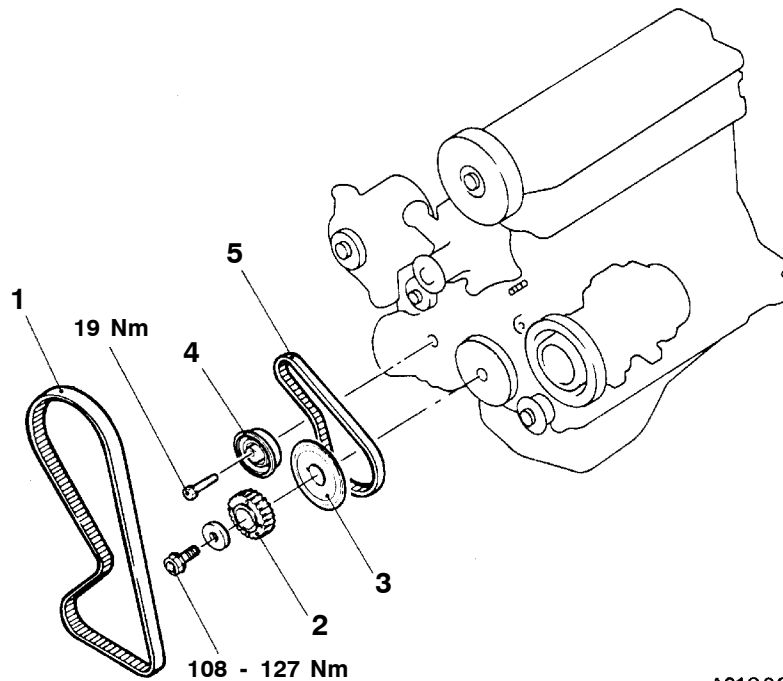
When tightening the fixing bolt, make sure that the tension pulley does not turn with the bolt.



3. Turn the crankshaft two revolutions in the clockwise direction so that the timing marks are aligned. After leaving it for 15 minutes, measure the amount of protrusion of the auto tensioner.

Standard value (A): 3.8 - 4.5 mm

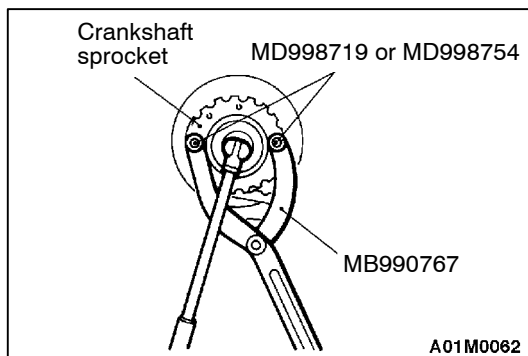
4. If the amount of protrusion is outside the standard value, repeat the operation in steps (1) to (3).
5. Check again to be sure that the timing marks of each sprocket are aligned.

TIMING BELT B**REMOVAL AND INSTALLATION**

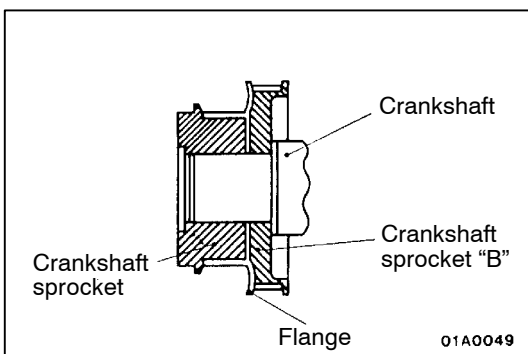
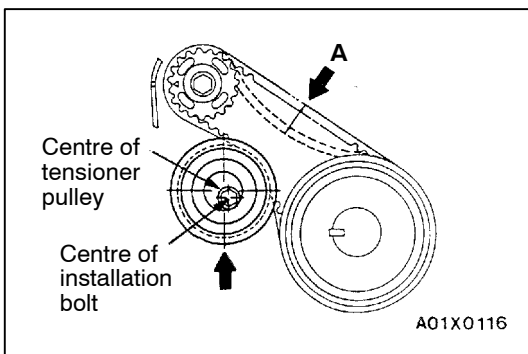
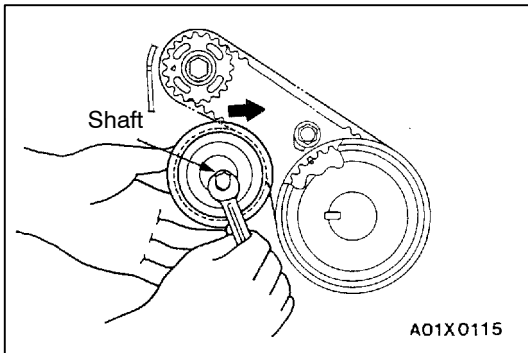
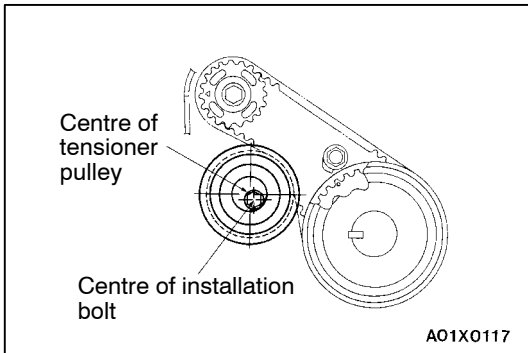
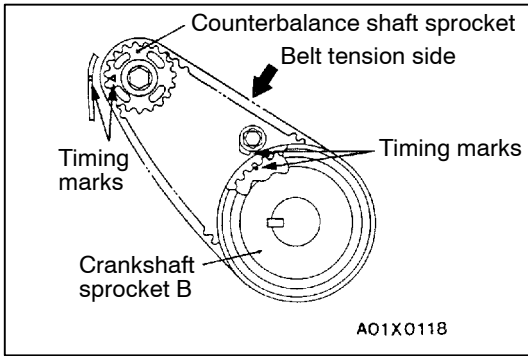
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Removal steps

- | | | | | | |
|-----|-----|-------------------------------------|-----|-----|----------------------------|
| ◀A▶ | ▶C▶ | 1. Timing belt (Refer to P.11C-27.) | ◀B▶ | ▶A▶ | 4. Timing belt B tensioner |
| | ▶B▶ | 2. Crankshaft sprocket | | | 5. Timing belt B |
| | | 3. Flange | | | |

**REMOVAL SERVICE POINTS****◀A▶ CRANKSHAFT SPROCKET REMOVAL****◀B▶ TIMING BELT B REMOVAL****Caution**

If timing belt "B" is to be re-used, use chalk to mark it with an arrow on its flat side indicating the turning direction (to the right).



INSTALLATION SERVICE POINTS

►A◄ TIMING BELT B INSTALLATION, ADJUSTMENT

1. Install timing belt "B" by the following procedure.
 - (1) Ensure that crankshaft sprocket "B" timing mark and the counterbalance shaft sprocket timing mark are aligned.
 - (2) Fit timing belt "B" over crankshaft sprocket "B" and the counterbalance shaft sprocket. Ensure that there is no slack in the belt.

2. Adjust the tension of timing belt "B" by the following procedure.
 - (1) Temporarily fix the timing belt "B" tensioner such that the centre of the tensioner pulley is to the left and above the centre of the installation bolt, and temporarily attach the tensioner pulley so that the flange is toward the front of the engine.

 - (2) Holding the timing belt "B" tensioner up with your finger in the direction of the arrow, place pressure on the timing belt so that the tension side of the belt is taut. Now tighten the bolt to fix the tensioner.

Caution

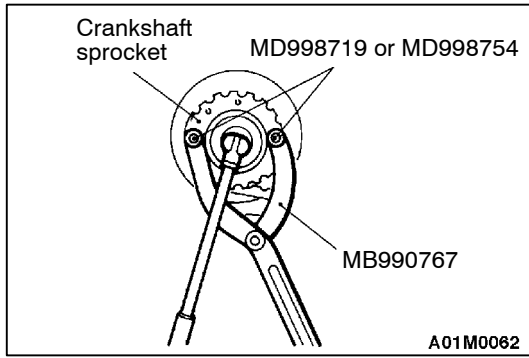
When tightening the bolt, ensure that the tensioner pulley shaft does not rotate with the bolt. Allowing it to rotate with the bolt can cause excessive tension on the belt.

3. To ensure that the tension is correct, depress the belt (point A) with a finger. If not, adjust.

Standard value: 5 - 7 mm

►B◄ FLANGE INSTALLATION

When installing, make sure the direction is correct. See figure.



▶◀ **CRANKSHAFT SPROCKET INSTALLATION**

NOTE

Apply the minimum amount of engine oil to the bearing surface and thread of the crankshaft bolt.

ENGINE ASSEMBLY

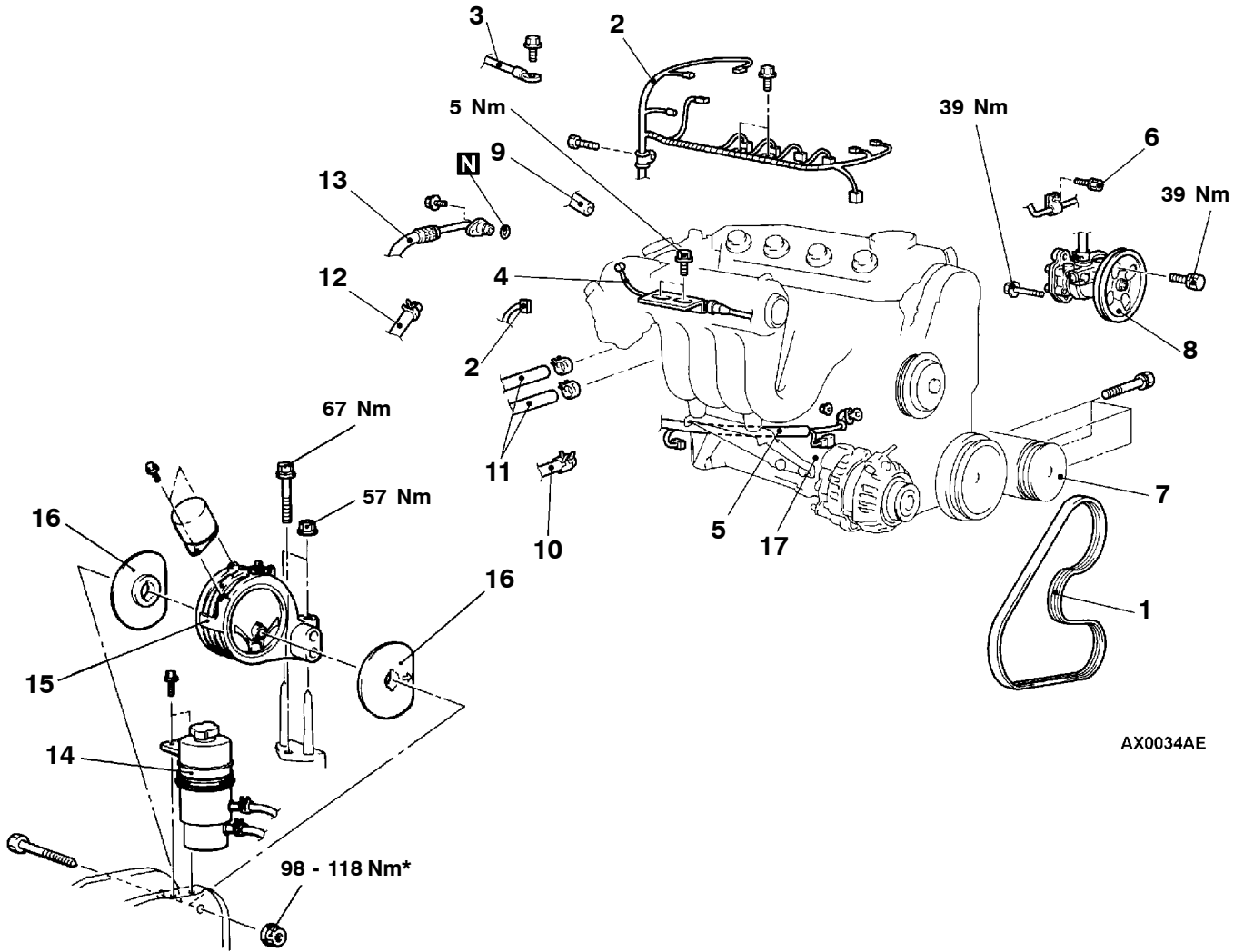
REMOVAL AND INSTALLATION

Caution

Mounting locations marked by * should be provisionally 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

- Fuel Discharge Prevention (Refer to GROUP 13D - On-vehicle Service.) <Pre-removal only>
- Engine Cover Removal and Installation
- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying
- Hood Removal and Installation
- Transmission Assembly Removal and Installation
- Drive Belt Tension Adjustment (Refer to P.11C-6.) <Post-installation only>
- Accelerator Cable Adjustment <Post-installation only>



Removal steps

- | | |
|--|--|
| 1. Drive belt (Power steering and A/C) | 10. Brake booster vacuum hose connection |
| 2. Engine harness connector | 11. Heater hose connection |
| 3. Earth cable connection | 12. Fuel return hose connection |
| 4. Accelerator cable connection | 13. Fuel pressure hose connection |
| 5. Alternator connector | 14. Power steering oil reservoir |
| 6. Power steering hose clamp | 15. Engine mount bracket |
| 7. A/C compressor | 16. Engine mount stopper |
| 8. Power steering oil pump | 17. Engine assembly |
| 9. Vacuum hose connection | |



REMOVAL SERVICE POINTS**◀A▶ A/C COMPRESSOR REMOVAL**

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

NOTE

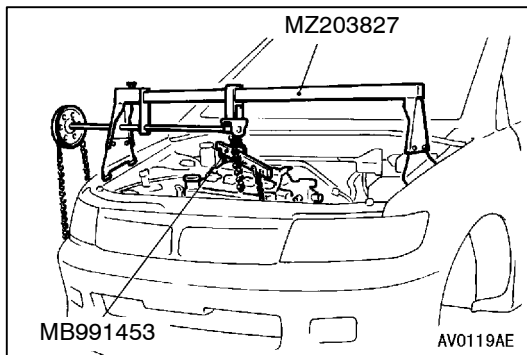
Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀B▶ POWER STEERING OIL PUMP REMOVAL

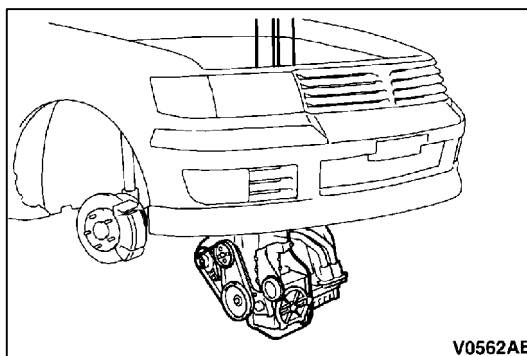
Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

NOTE

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

**◀C▶ ENGINE MOUNT BRACKET REMOVAL**

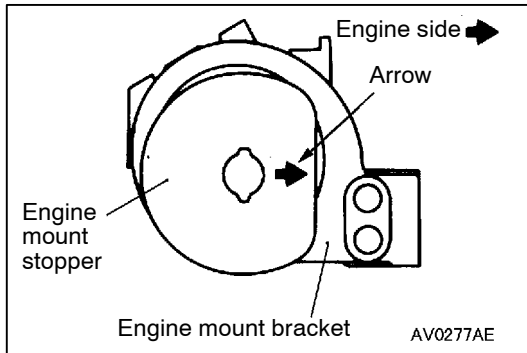
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so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

**◀D▶ ENGINE ASSEMBLY REMOVAL**

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

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

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

**▶B◀ENGINE MOUNT STOPPER INSTALLATION**

Clamp the engine mount stopper so that the arrow points in the direction as shown in the diagram.

▶C◀ENGINE MOUNT BRACKET INSTALLATION

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