

GENERAL INFORMATION

Items		6G72 engine	6G74 engine
Total displacement ml		2,972	3,497
Bore x Stroke mm		91.1 x 76.0	93.0 x 85.8
Compression ratio		9.0	
Combustion chamber		Pentroof type	
Camshaft arrangement		SOHC	
Number of valve	Intake	12	
	Exhaust	12	
Valve timing	Intake opening	BTDC 19°	BTDC 5°
	Intake closing	ABDC 45°	ABDC 55°
	Exhaust opening	BBDC 49°	BBDC 51°
	Exhaust closing	ATDC 15°	ATDC 17°
Fuel system		Electronic control multipoint fuel injection	
Rocker arm		Roller type	
Auto-lash adjuster		Equipped	

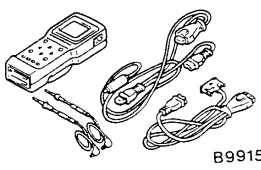
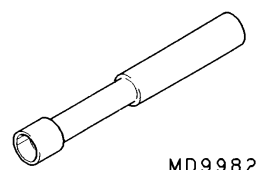
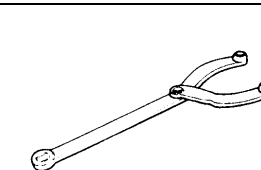
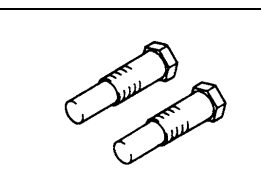
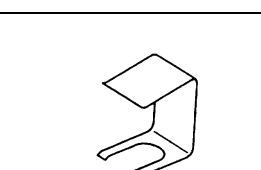
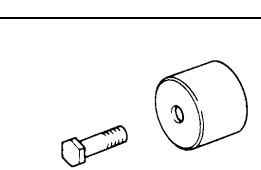
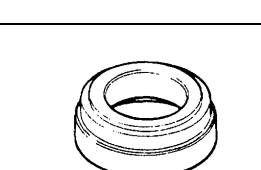
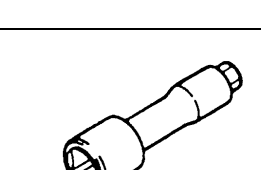
SERVICE SPECIFICATIONS

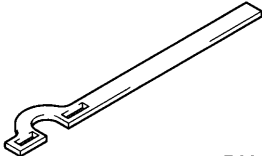
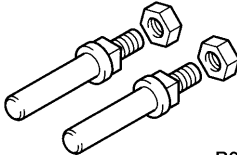
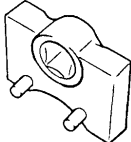
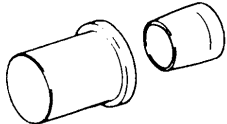

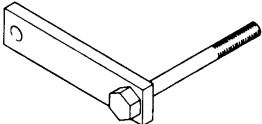
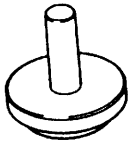
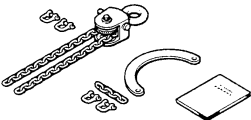
Item		Standard value	Limit
Basic ignition timing mm		5° BTDC ± 3°	–
Ignition timing	6G72 engine	Approx. 15° BTDC	–
	6G74 engine	Approx. 10° BTDC	–
Idle speed r/min		700 ± 100	–
CO contents %	Vehicles without catalytic converter	1.5 ± 0.5	–
	Vehicles with catalytic converter	0.5 or less	–
Compression pressure (at engine speed of 250 – 400 r/min) kPa		1,177	Min. 875
Compression pressure difference of all cylinder kPa		–	Max. 98
Intake manifold vacuum kPa		–	Min. 60
Auto tensioner rod depth (mm)		Within 1	–
Timing belt tension torque Nm		4.4	–
Auto tensioner rod protrusion amount mm		3.8 – 5.0	–

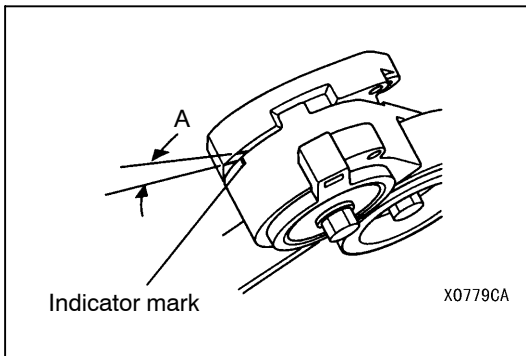
SEALANT

Items	Specified sealant	Remarks
Camshaft position sensor Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> • Checking the ignition timing • Checking the idle speed
 MD998299	MD998299	MAS screwdriver	Adjustment of the mixture adjusting screw <Vehicles without catalytic converter>
	MB990767	End yoke holder	<ul style="list-style-type: none"> • Supporting of crankshaft pulley • Supporting of camshaft sprocket
	MD998715	Crankshaft pulley holder pin	
	MD998443	Auto-lash adjuster holder	Supporting of auto-lash adjuster
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
	MB991559	Camshaft oil seal adapter	Press-fitting the camshaft oil seal (left bank side)
	MD998051	Cylinder head bolt wrench	Removal and installation of the cylinder head bolt

Tool	Number	Name	Use
 B991800	MB991800	Pulley holder	Supporting of crankshaft pulley
 B991802	MB991802	Pin B	
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
	MD998769	Crankshaft pulley spacer	Operating the crankshaft when installing the timing belt
	MD998781	Flywheel stopper	Securing the flywheel
	MD998718	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
 B991683	MB991683	Sling chain set	Removal and installation of engine assembly



ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK

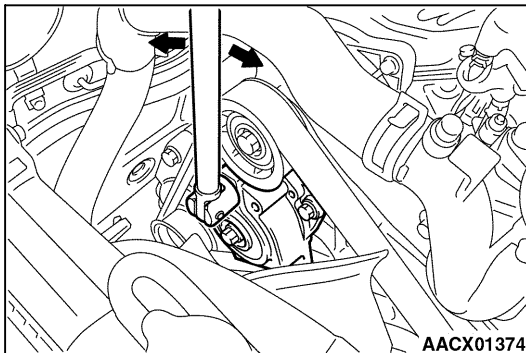
Caution

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.

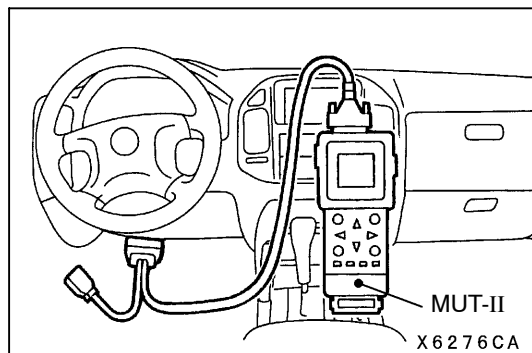
NOTE

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



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.11B-15.)
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.11B-15.)



IGNITION TIMING 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. 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: 700 ± 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 13B – 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.

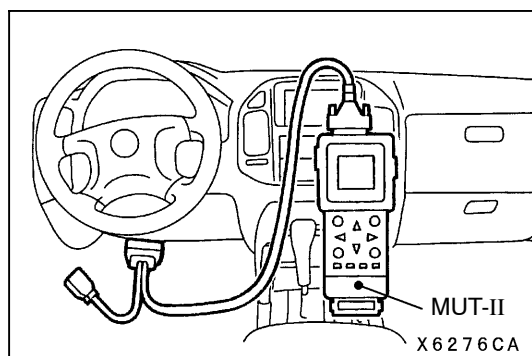
Standard value:

<6G72> approx. 15° BTDC

<6G74> 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 AND MIXTURE CHECK AND ADJUSTMENT <Vehicles without catalytic converter>

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position and connector 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: 700 ± 100 r/min

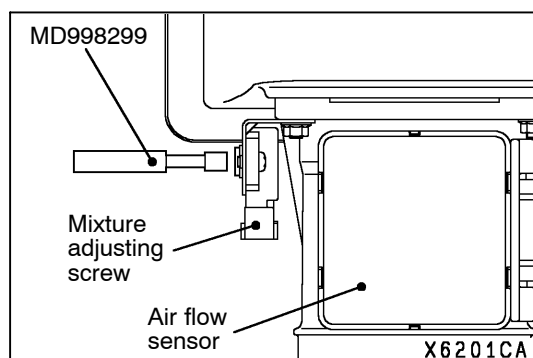
NOTE

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

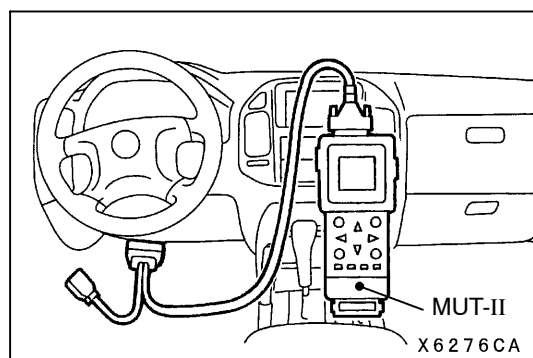
6. If the idle speed is outside the standard value, inspect the MPI components by referring to GROUP 13B – Troubleshooting.
7. Set the CO tester.

8. Run the engine for more than 10 seconds at 2,000 to 3,000 r/min.
9. Check the CO contents at idle.

Standard value: 1.5 ± 0.5 %



10. If there is deviation from the standard value, set the idle mixture to the specified value by adjusting the mixture adjusting screw (variable resistor). Use the special tool (MAS screwdriver) to turn the mixture adjusting screw.



IDLE SPEED CHECK <Vehicles with catalytic converter>

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 $\pm 3^\circ$

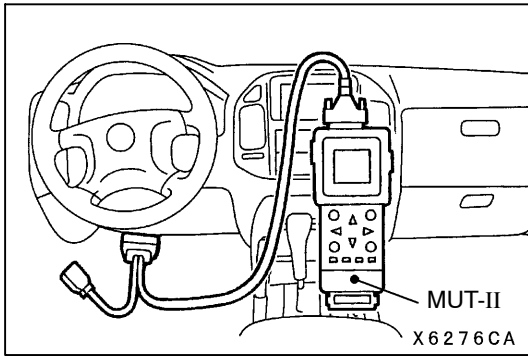
4. Run the engine at idle for 2 minutes.
5. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

Curb idle speed: 700 ± 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 13B – Troubleshooting.



IDLE MIXTURE CHECK <Vehicles with catalytic converter>

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°

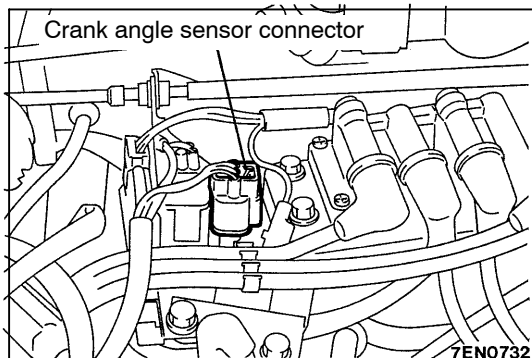
4. Run the engine at 2500 r/min for 2 minutes.
5. Set the CO tester.
6. Check the CO contents and the HC contents at idle.

CO contents: 0.5% 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
 - Evaporative emission control system
 - Compression pressure

NOTE

Replace the three way catalyst when the CO 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 engine oil, the starter and battery are normal. Also, set the vehicle to the pre-inspection condition.
2. Remove all the spark plugs.
3. Disconnect the crank angle sensor connector.

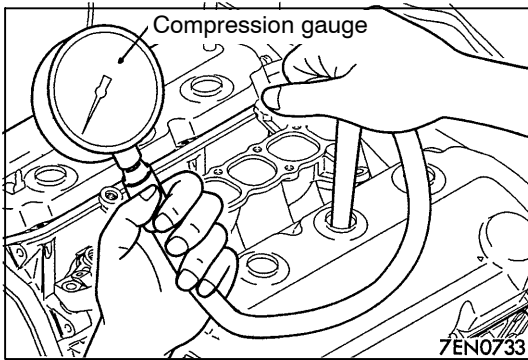
NOTE

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

4. Cover the spark plug hole with a shop towel etc. and crank the engine. Then 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 hole.
6. Turn over the engine and measure the compression pressure.

Standard value (at engine speed of 250 – 400 r/min):
1,177 kPa

Limit (at engine speed of 250 – 400 r/min):
Min. 875 kPa

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

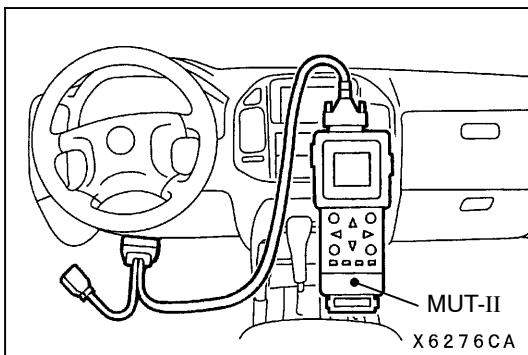
Limit: Max. 98 kPa

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 step 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.

Use the MUT-II to erase the self-diagnosis codes or disconnect the battery cable from the battery (–) terminal for 10 seconds or more and then reconnect the cable.

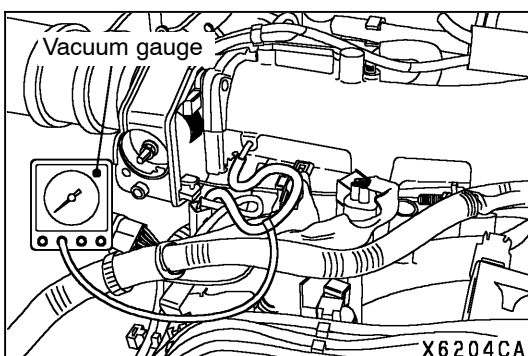
NOTE

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



MANIFOLD VACUUM CHECK

1. Start the engine and allow it to warm up until the temperature of the engine coolant reaches 85 to 95°C.
2. Turn the ignition switch to LOCK (OFF) position.
3. Connect the tachometer or connect the MUT-II to the diagnosis connector.



4. Attach a three-way union to the vacuum hose between the fuel pressure regulator and the air intake plenum, and connect a vacuum gauge.
5. Start the engine and check that idle speed is within the standard value.

Standard value: 700 ± 100 r/min

6. Check the intake manifold vacuum.

Limit: Min. 60 kPa

LASH ADJUSTER CHECK

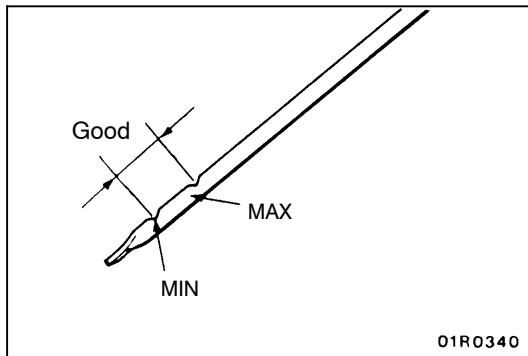
If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

NOTE

- (1) 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

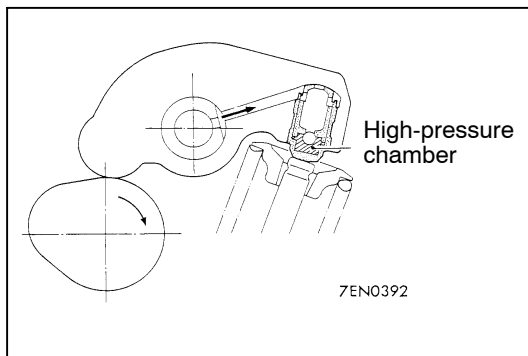
1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the 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.11B-12.)
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.

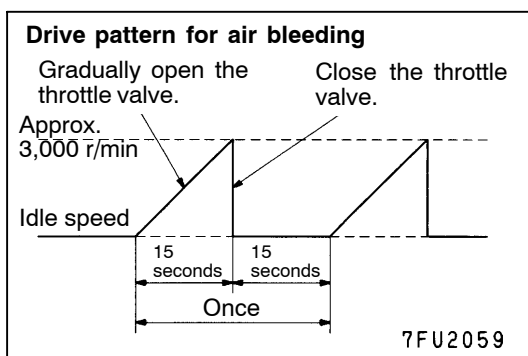
NOTE

- (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.



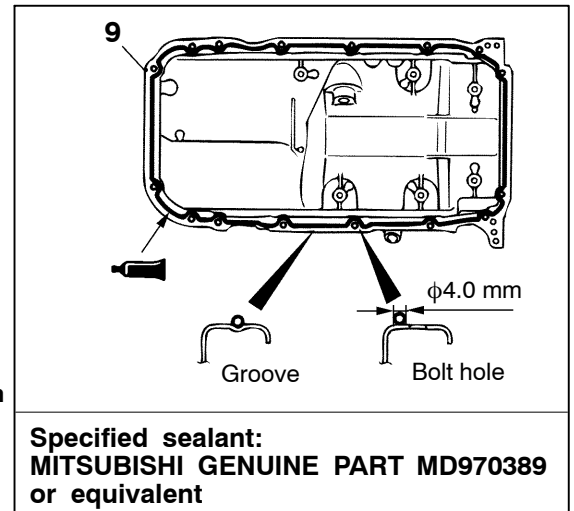
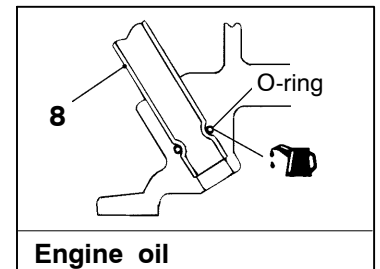
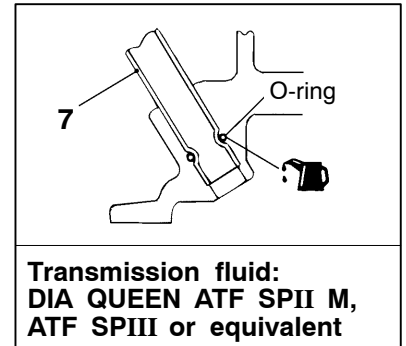
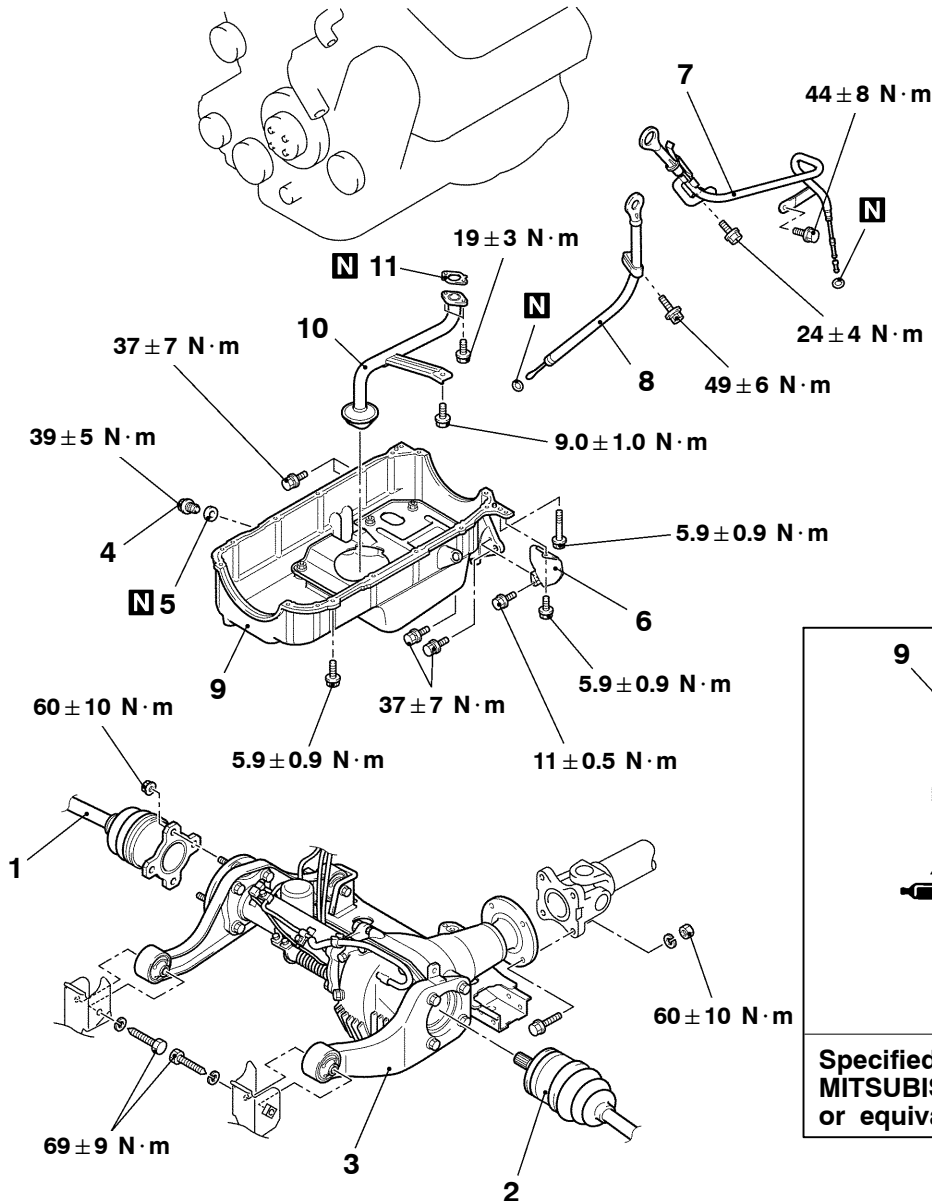
2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level 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.)
- Stater Motor Removal and Installation (Refer to GROUP 16.)



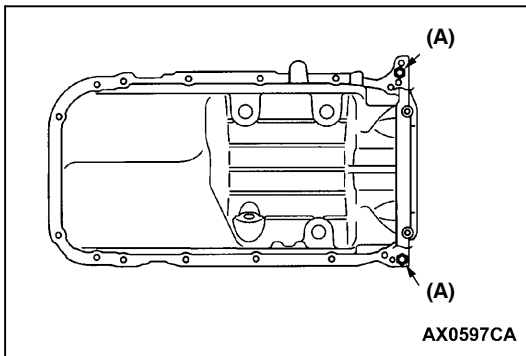
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Removal steps

1. Drive shaft (R.H.) connection
2. Drive shaft (L.H.) connection
3. Front differential number 2 crossmember assembly
4. Drain plug
5. Drain plug gasket



6. Cover
7. A/T fluid dipstick assembly
8. Engine oil dipstick assembly
9. Oil pan
10. Oil screen
11. Gasket



REMOVAL SERVICE POINT

◀A▶ OIL PAN LOWER REMOVAL

1. Remove the oil pan installation bolt.

Caution

Do not use the oil pan remover (MD998727). It will damage the oil pan (aluminum made).

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

INSTALLATION SERVICE POINTS

▶A◀ OIL PAN INSTALLATION

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

NOTE:

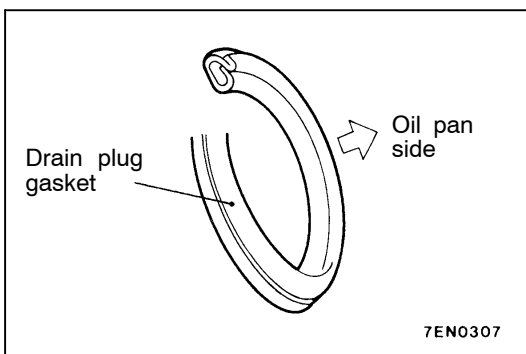
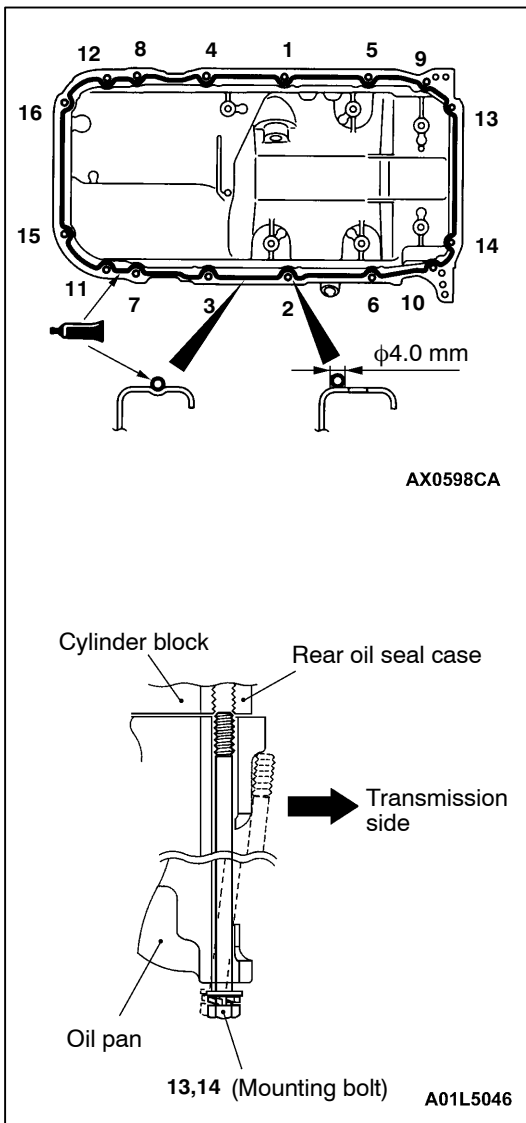
The sealant should be applied in a continuous bead approximately 4.0 mm in diameter.

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

Caution

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

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



▶B◀ DRAIN PLUG GASKET INSTALLATION

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

INSPECTION

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

TIMING BELT

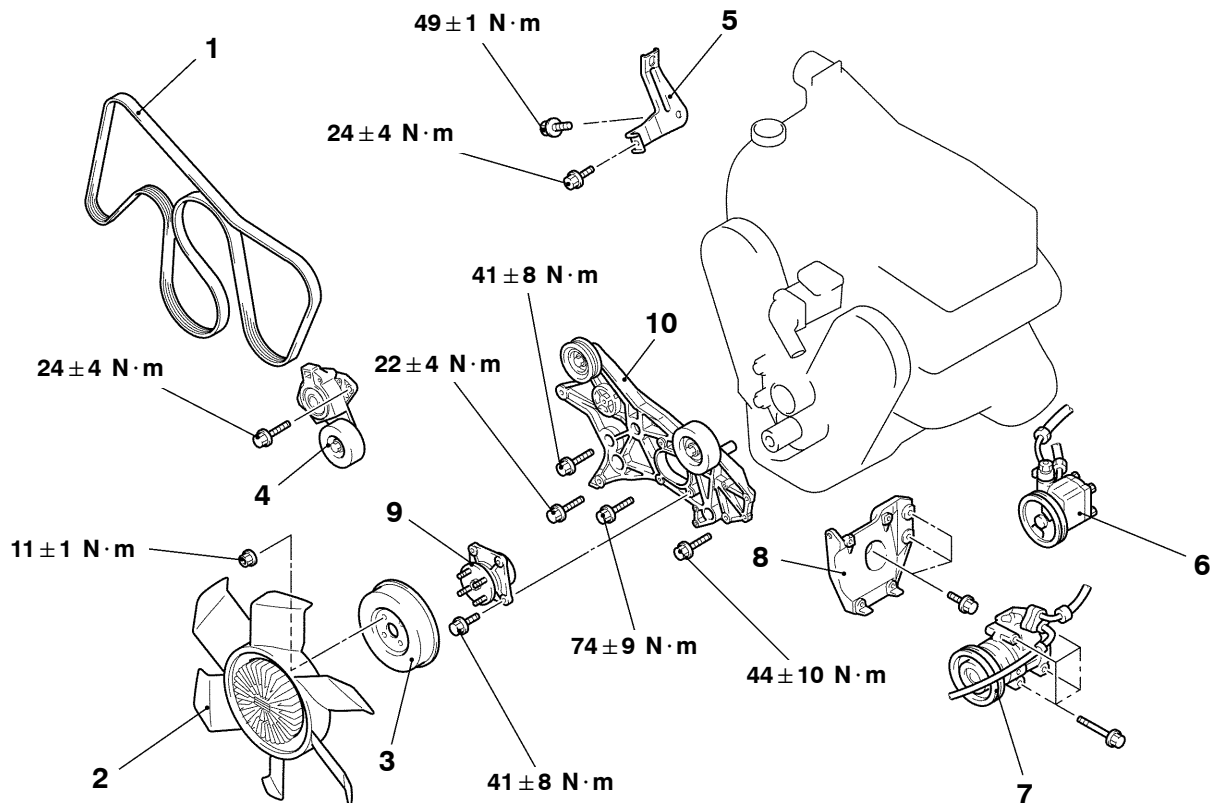
REMOVAL AND INSTALLATION

Pre-removal Operation

- Under Skid Plate, Undercover Removal
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service.)
- Battery and Battery Tray Removal
- Air Cleaner and Air Intake Hose Removal (Refer to GROUP 15 – Air Cleaner.)
- Radiator Shroud Cover Removal (Refer to GROUP 14 – Radiator.)

Post-installation Operation

- Radiator Shroud Cover Installation (Refer to GROUP 14 – Radiator.)
- Air Cleaner and Air Intake Hose Installation (Refer to GROUP 15 – Air Cleaner.)
- Battery and Battery Tray Installation
- Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service.)
- Under Skid Plate, Undercover Installation



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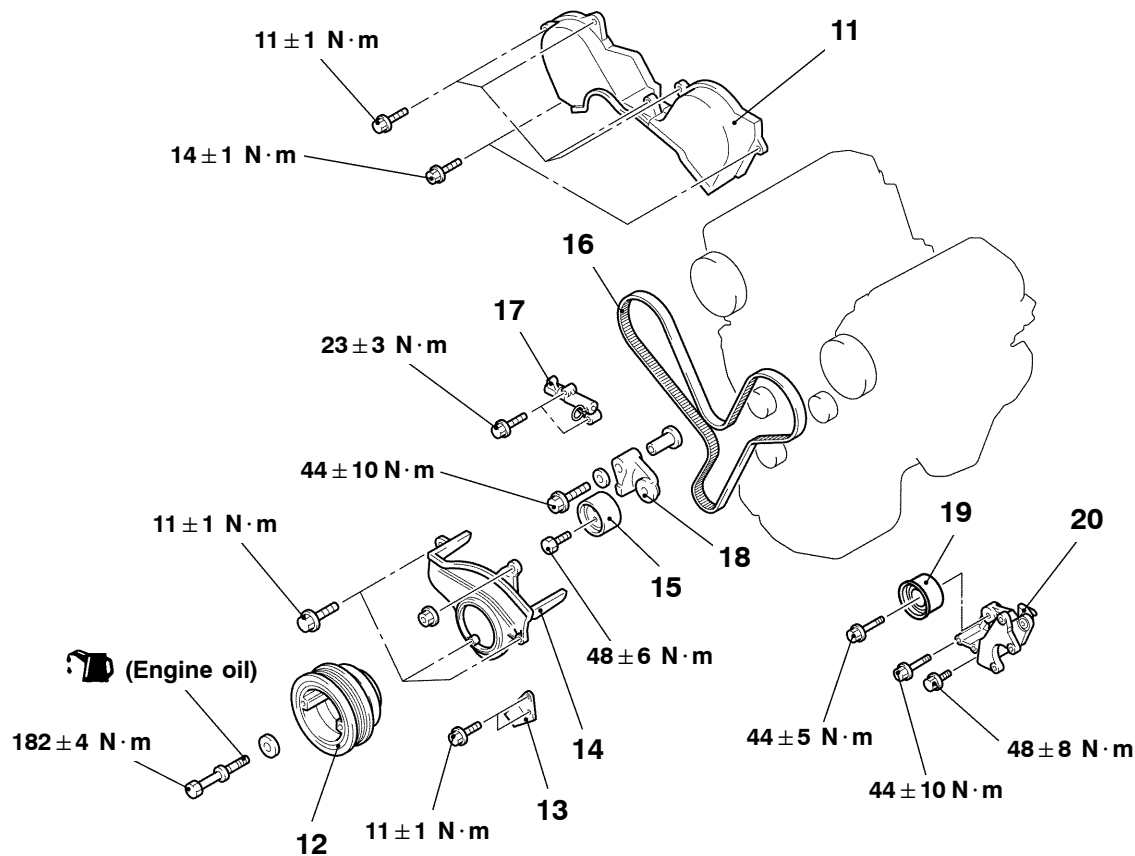
Removal steps

1. Drive belt
2. Cooling fan
3. Cooling fan pulley
4. Drive belt auto tensioner
5. Accessory mount stay
6. Power steering oil pump assembly
7. A/C compressor assembly
8. Compressor bracket
9. Cooling fan bracket assembly
10. Accessory mount assembly

◀A▶▶E▶

◀B▶
◀B▶

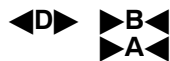
▶D▶



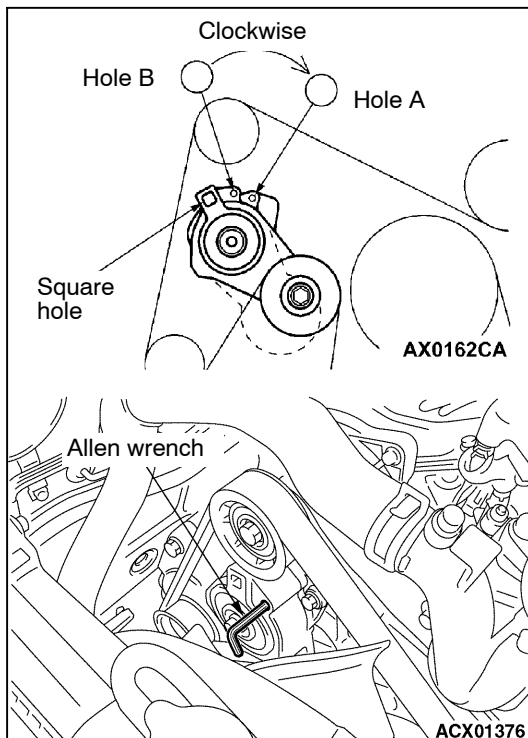
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11. Timing belt upper cover assembly
 12. Crankshaft pulley
 13. Timing belt indicator bracket
 14. Timing belt lower cover assembly
 15. Tension pulley



16. Timing belt
 17. Auto-tensioner
 18. Tensioner arm assembly
 19. Idler pulley
 20. Power steering oil pump bracket



REMOVAL SERVICE POINTS

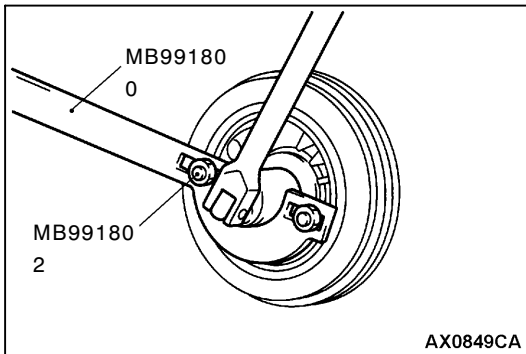
◀A▶ DRIVE BELT AUTO TENSIONER REMOVAL

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

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

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

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



◀C▶ CRANKSHAFT PULLEY REMOVAL

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

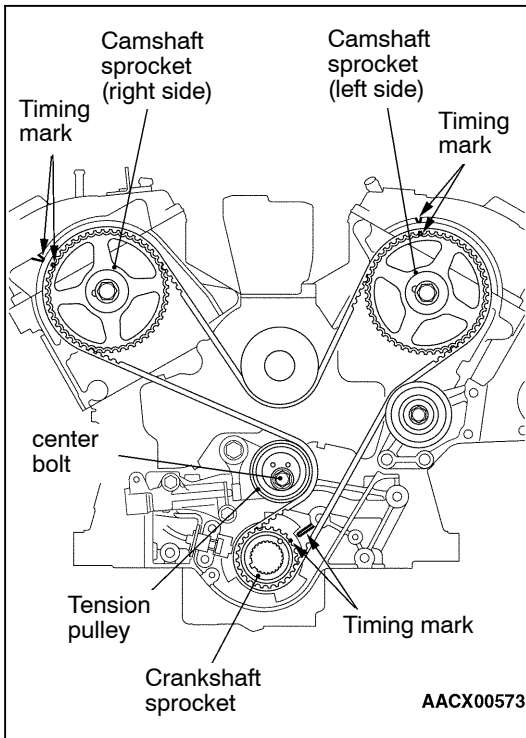
◀D▶ TIMING BELT REMOVAL

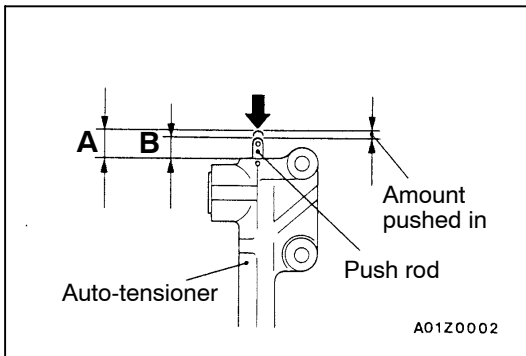
1. Turn the crankshaft clockwise to align each timing mark and to set the No. 1 cylinder to compression top dead center.

Caution

Never turn the crankshaft counterclockwise.

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 center 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.

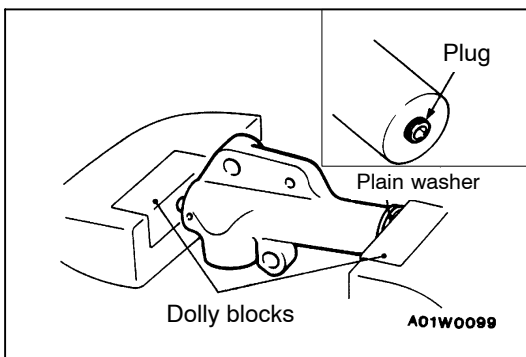
Standard value: Within 1 mm

A: Length when no force is applied

B: Length when force is applied

A – B: Amount pushed in

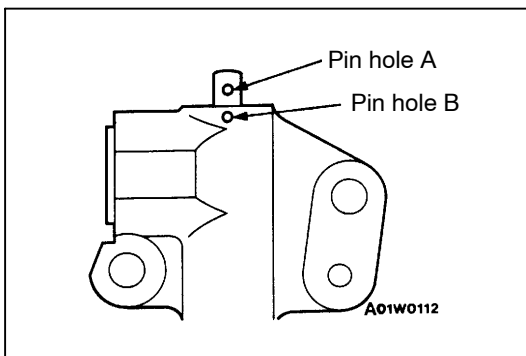
2. If it is not within the standard value, replace the auto-tensioner.



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.

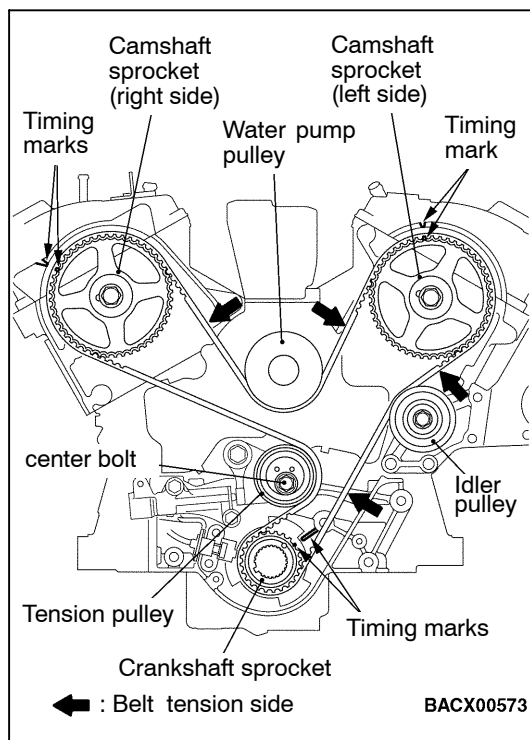
NOTE

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.



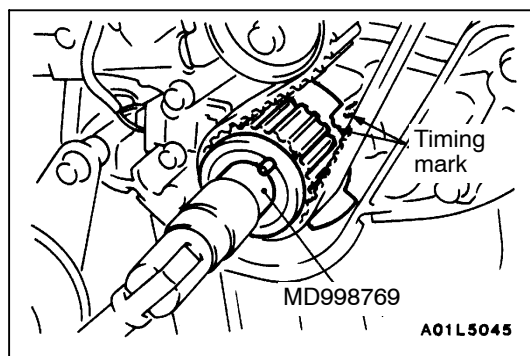
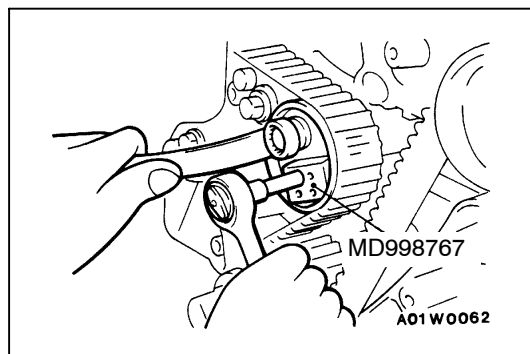
►B◄ TIMING BELT INSTALLATION

1. Align the timing marks of the camshaft sprocket with those of crankshaft sprocket.
2. Install the timing belt by the following procedure so that there is no deflection in the timing belt between each sprocket and pulley.
 - (1) Crankshaft sprocket
 - (2) Idler pulley
 - (3) Camshaft sprocket (Left side)
 - (4) Water pump pulley
 - (5) Camshaft sprocket (Right side)
 - (6) Tension pulley

Caution

The camshaft sprocket (right side) can turn easily due to the spring force applied, so be careful not to get your fingers caught.

3. Turn the camshaft sprocket counterclockwise until the tension side of the timing belt is firmly stretched. Check all timing marks again.
4. Use special tool to push the tensioner pulley into the timing belt, and then temporarily tighten the center bolt.



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

6. Loosen the center 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 center bolt to the specified torque.

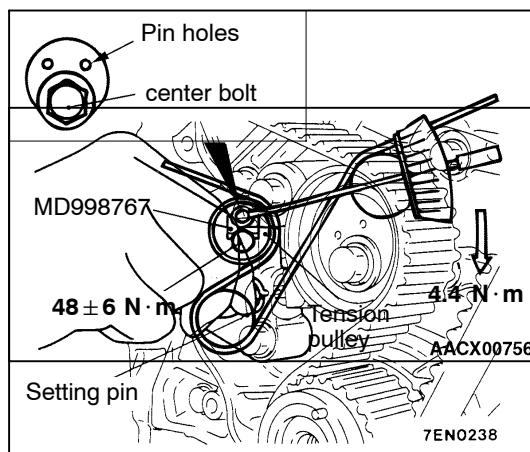
Standard value: 4.4 N·m

<Timing belt tension torque>

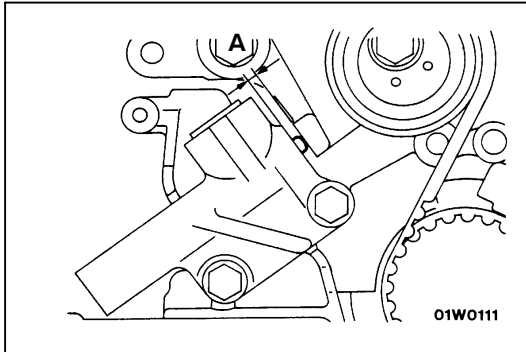
Caution

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

7. Remove the setting pin that has been inserted into the auto-tensioner.



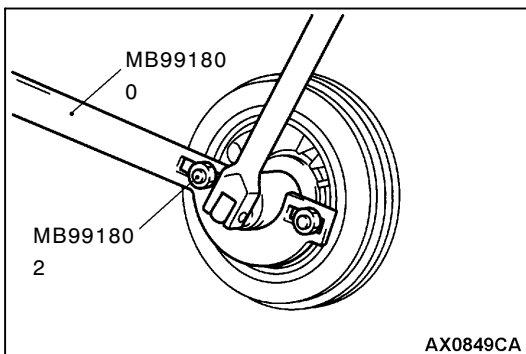
8. Turn the crankshaft two turns clockwise to align the timing marks.



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

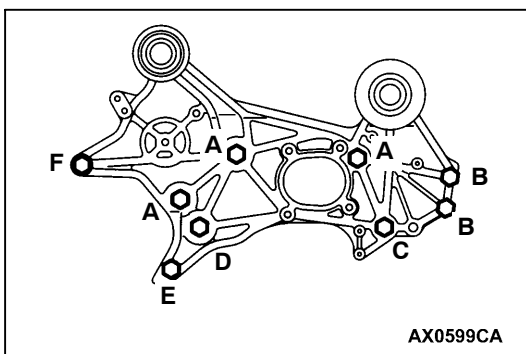
Standard value (A): 3.8 – 5.0 mm

10. If no, repeat the operation in steps (5) to (9) above.
11. Check again that the timing marks of each sprocket are aligned.



►C◄ CRANKSHAFT PULLEY INSTALLATION

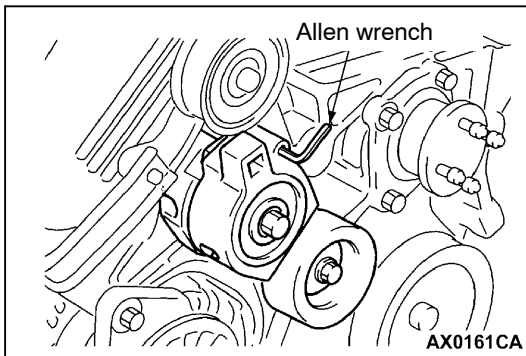
Use special tools to install the crankshaft pulley.



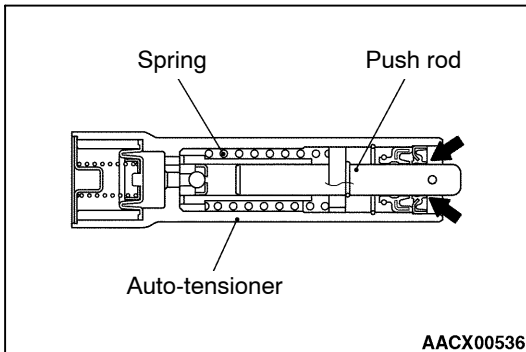
►D◄ ACCESSORY MOUNT ASSEMBLY INSTALLATION

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.
3. Check for proper tension. (Refer to P.11B-6.)

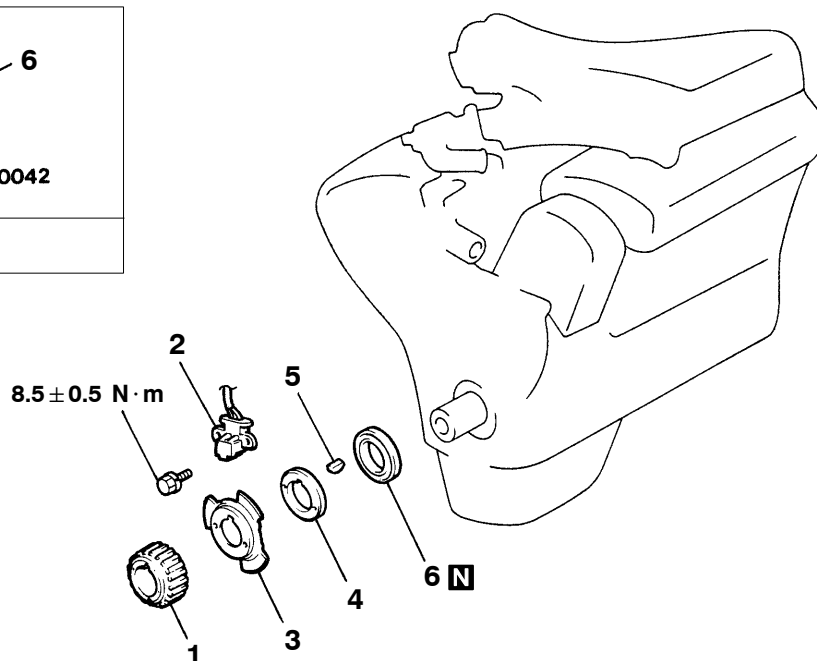
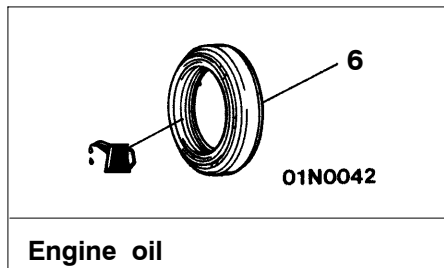
**INSPECTION****AUTO-TENSIONER**

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

CRANKSHAFT FRONT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Timing Belt Removal and Installation (Refer to P.11B-15.)

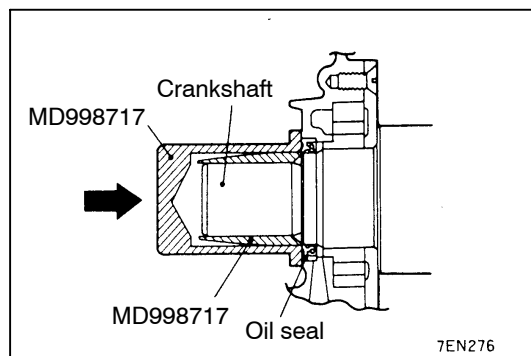


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Removal steps

- B◄ 1. Crankshaft sprocket
- 2. Crankshaft position sensor
- B◄ 3. Crankshaft sensing blade

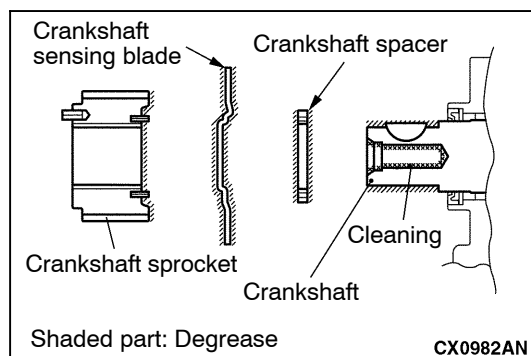
- B◄ 4. Crankshaft spacer
- 5. Key
- A◄ 6. Crankshaft front oil seal



INSTALLATION SERVICE POINTS

►A◄ 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.



►B◄ CRANKSHAFT SPACER/CRANKSHAFT SENSING BLADE/CRANKSHAFT SPROCKET

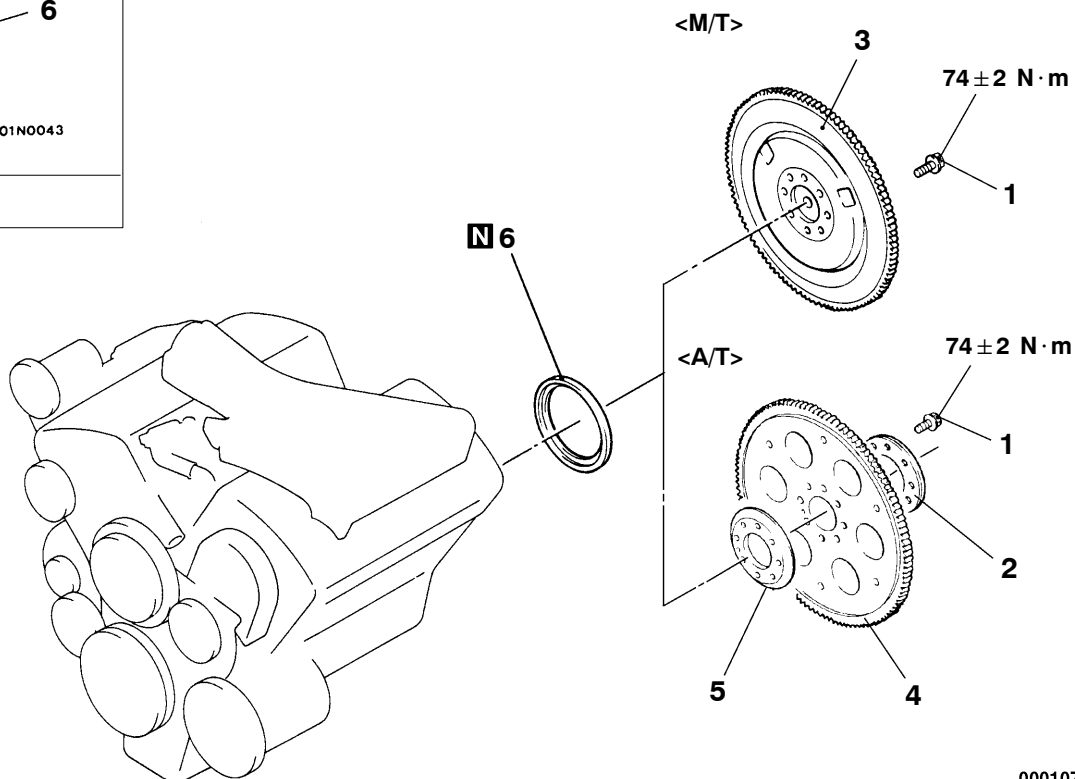
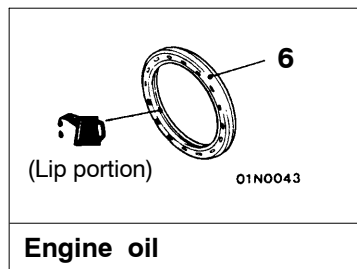
To prevent the crankshaft pulley mounting bolt from loosening, degrease or clean the crankshaft, the crankshaft spacer, the crankshaft sensing blade and the crankshaft at the shown positions.

CRANKSHAFT REAR OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

Transmission and Transfer Assembly Removal and Installation (Refer to GROUP 22,23 – Transmission Assembly.)



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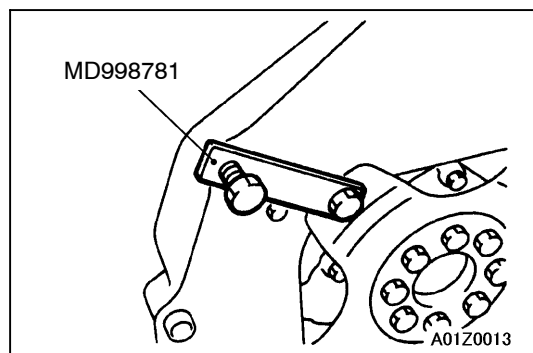
Removal steps

- Clutch cover and clutch disc

◀A▶ ▶B▶

1. Bolt
2. Adaptor plate
3. Flywheel

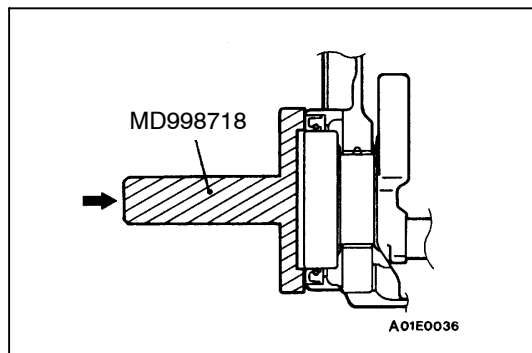
- ▶A▶
4. Drive plate
 5. Crankshaft adaptor
 6. Crankshaft rear oil seal



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

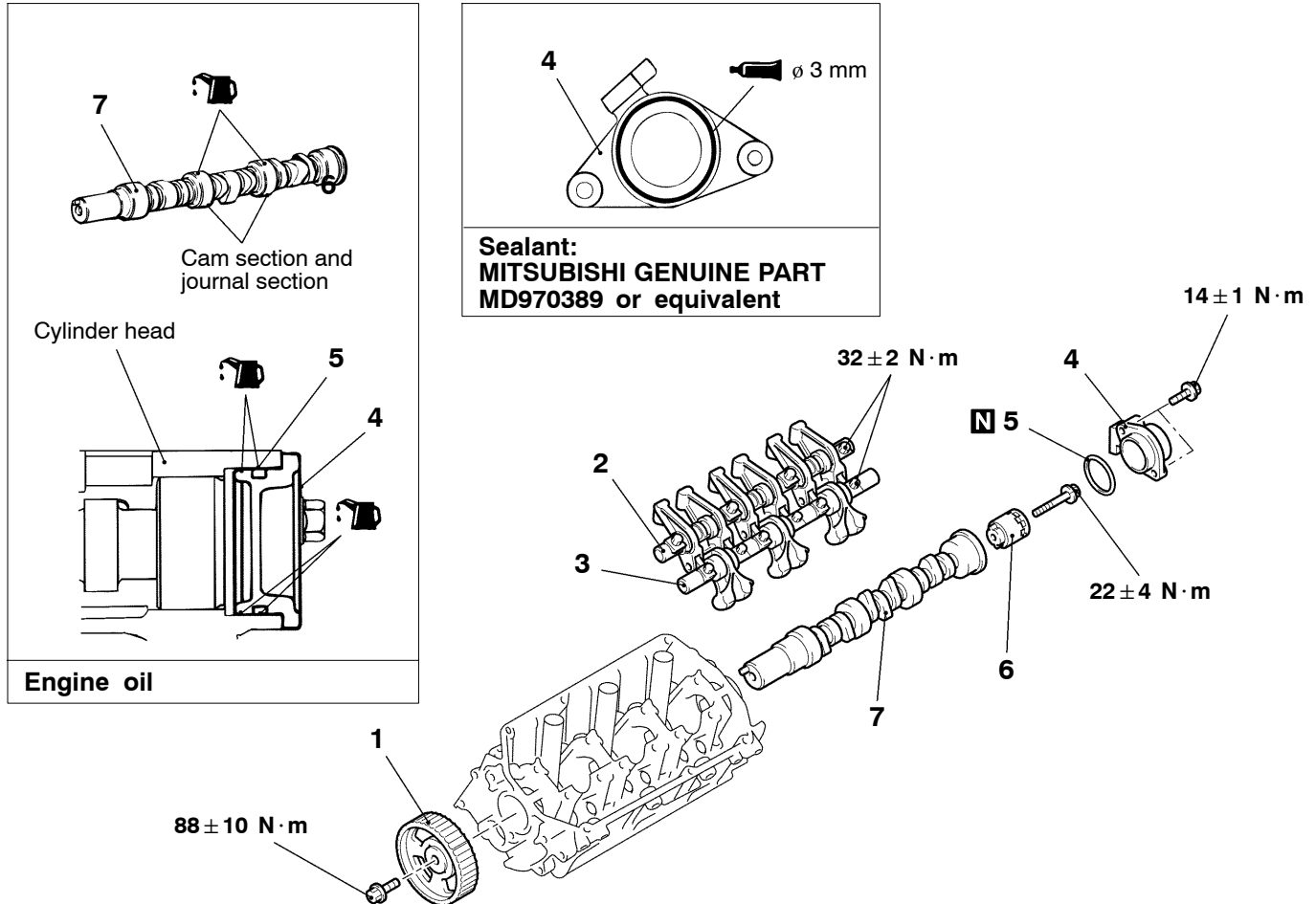
Use special tool in the same way as during removal to install the bolt.

CAMSHAFT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

Cylinder Head Assembly Removal and Installation
(Refer to P.11B-29.)

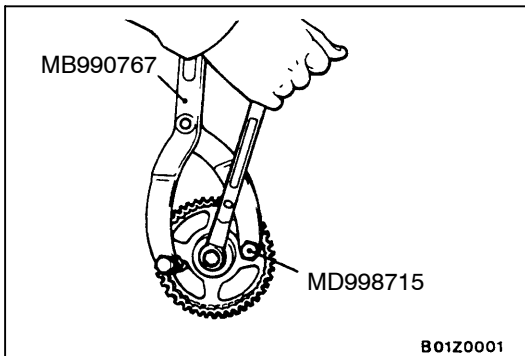


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Removal steps



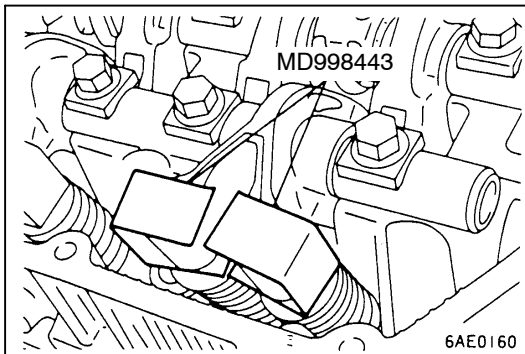
1. Camshaft sprocket
2. Rocker arm and shaft assembly (intake side)
3. Rocker arm and shaft assembly (exhaust side)
4. Camshaft position sensor support <Vehicles for Taiwan>
5. O-ring
6. Sensing camshaft position cylinder
7. Camshaft



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

Use special tools to remove the camshaft sprocket.

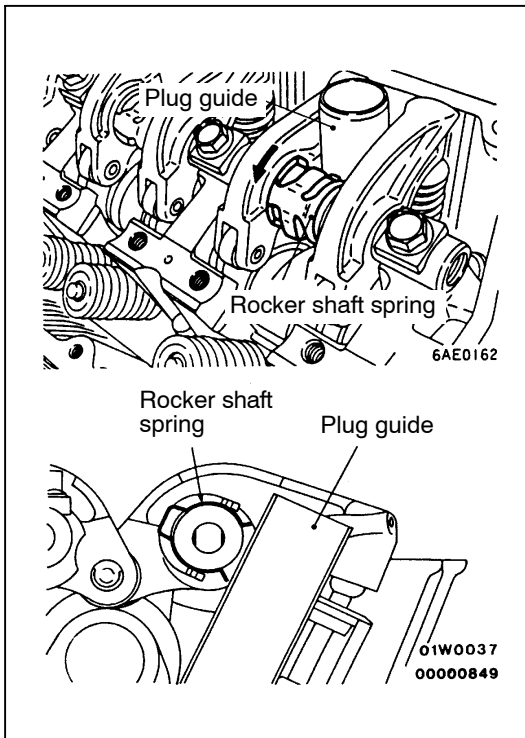


◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

1. Install special tool as shown in the illustration so that the lash adjusters will not fall out.
2. 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▶ 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. Tighten the rocker arm and shaft assembly mounting bolt to the specified torque.

Tightening torque: $32 \pm 2 \text{ N} \cdot \text{m}$

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

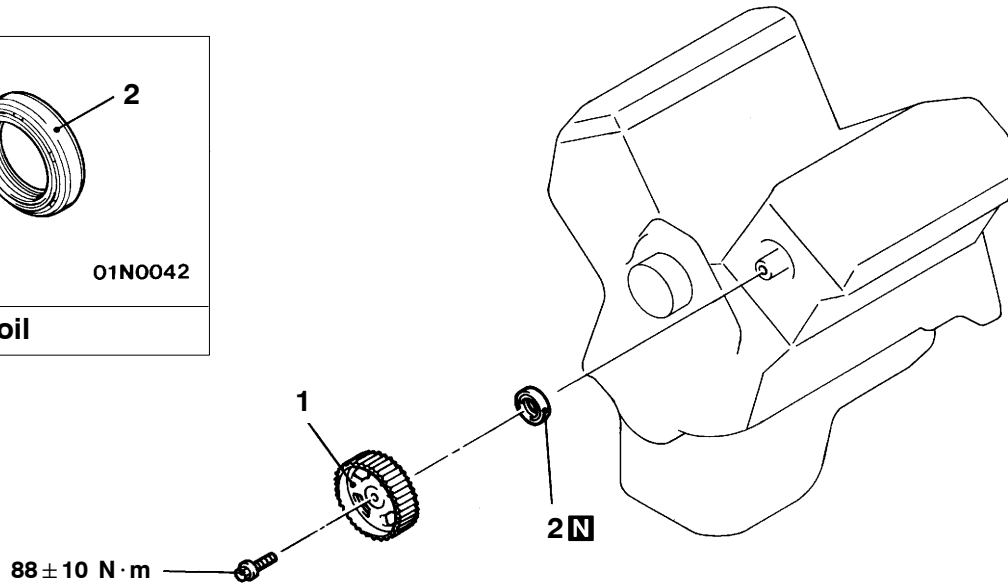
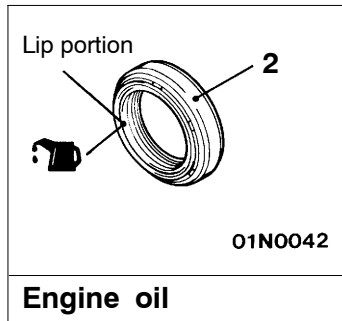
▶B▶ CAMSHAFT SPROCKET INSTALLATION

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

CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Timing Belt Removal and Installation (Refer to P.11B-15.)

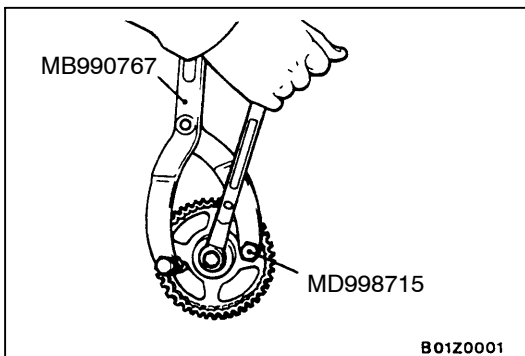


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Removal steps

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



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

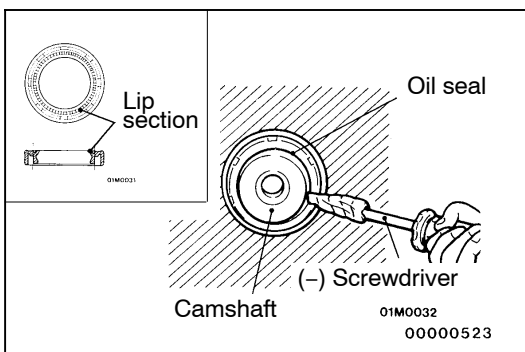
Use special tools to remove the camshaft sprocket.

◀B▶ CAMSHAFT OIL SEAL REMOVAL

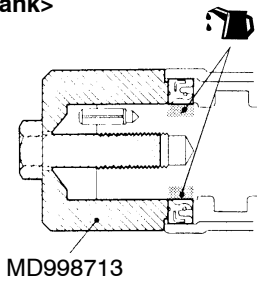
1. Make a notch in the oil seal lip section with a knife, etc.
2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the oil seal, and pry out the oil seal to remove it.

Caution

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



<Right bank>

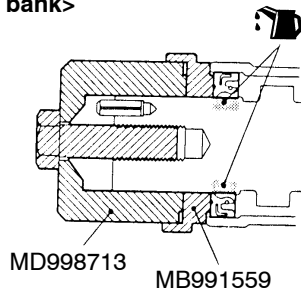


01X0075

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.

<Left bank>



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►B◄ CAMSHAFT SPROCKET INSTALLATION

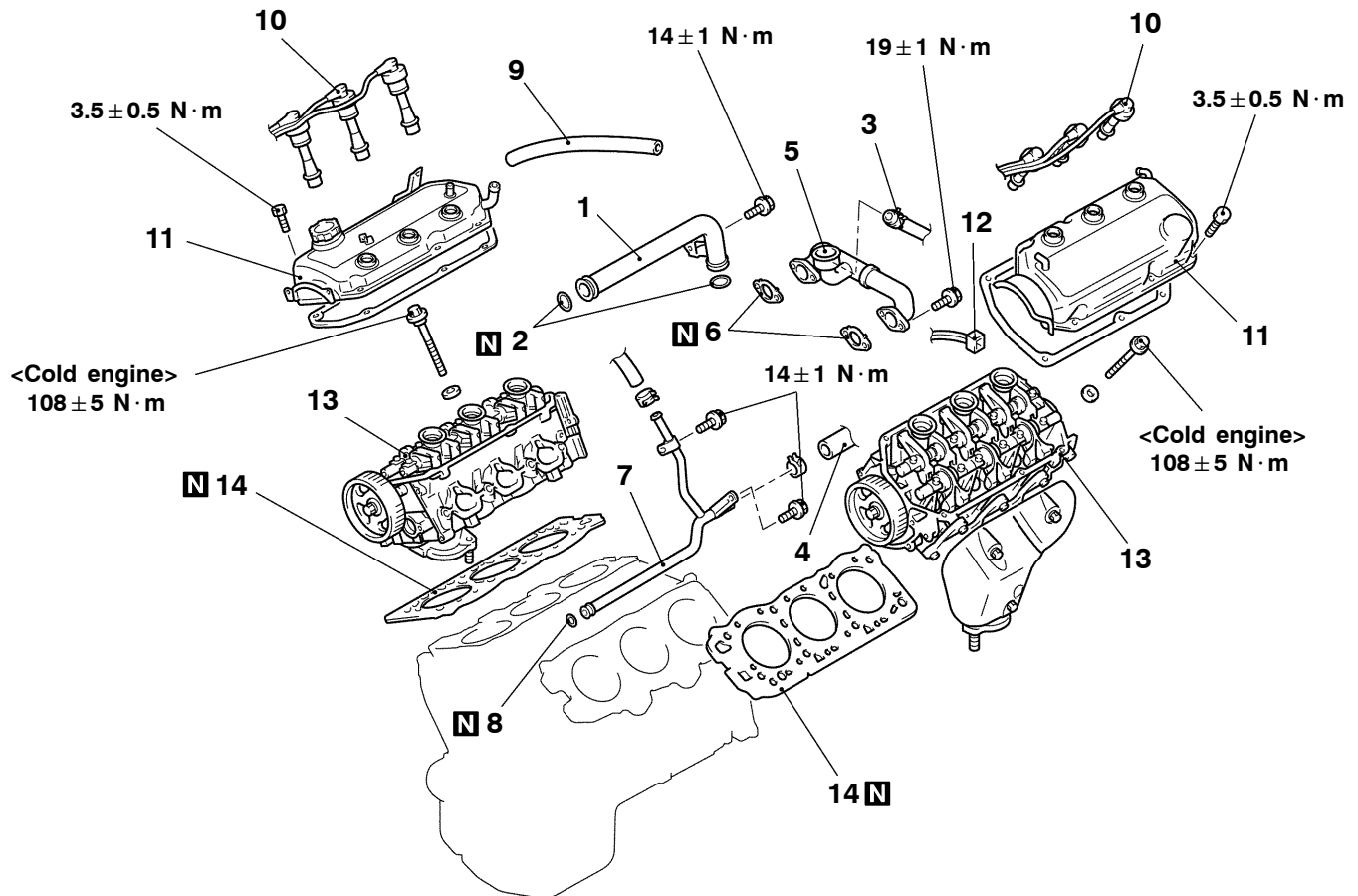
Use special tools in the same way as during removal to install the camshaft sprocket.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

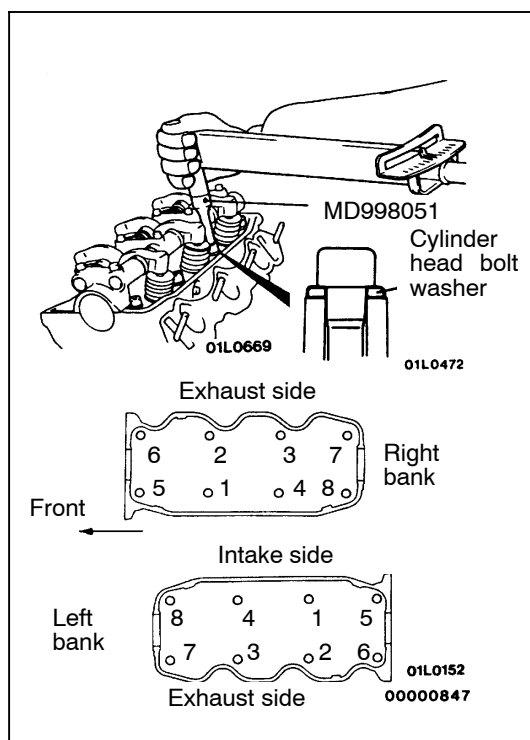
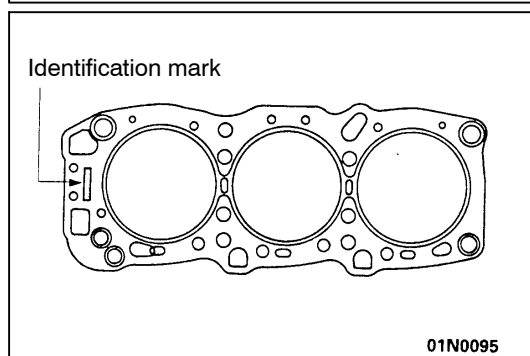
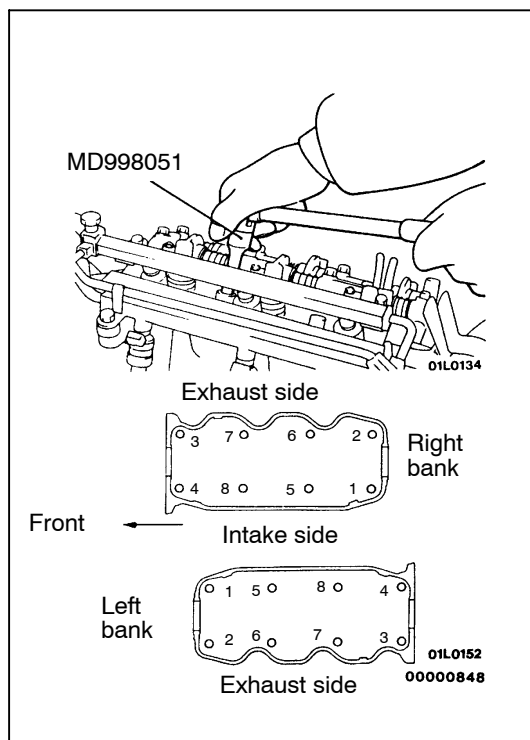
- Intake Manifold Removal and Installation (Refer to GROUP 15 – Intake Manifold.)
- Timing Belt Removal and Installation (Refer to P.11B-15.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)



AACX00535

Removal steps

- | | | |
|-----|-------------------------------|--|
| ▶C◀ | 1. Water outlet pipe assembly | 9. Breather hose |
| ▶D◀ | 2. O-ring | 10. Spark plug cable |
| ▶D◀ | 3. Heater hose connection | 11. Rocker cover |
| ▶D◀ | 4. Heater hose connection | 12. Camshaft position sensor connector |
| ▶D◀ | 5. Water passage assembly | <when removing left bank only> |
| ▶D◀ | 6. Gasket | ▶B◀ 13. Cylinder head assembly |
| ▶C◀ | 7. Water pipe assembly | ▶A◀ 14. Cylinder head gasket |
| ▶C◀ | 8. O-ring | |



REMOVAL SERVICE POINT

◀A▶ CYLINDER HEAD ASSEMBLY REMOVAL

Use special tool to tighten each bolt two or three steps in the order shown in the illustration.

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

1. Use a scraper to clean the gasket surface of the cylinder head assembly.

Caution

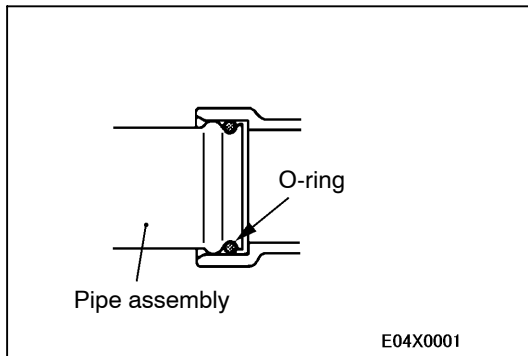
Be careful that no foreign material gets into the cylinder, coolant passages or oil passages. Engine damage may result.

2. Using special tool and a torque wrench, tighten the bolts to the specified torque in the order shown in the illustration. (in two or three cycles)

Tightening torque: 108 ± 5 N·m

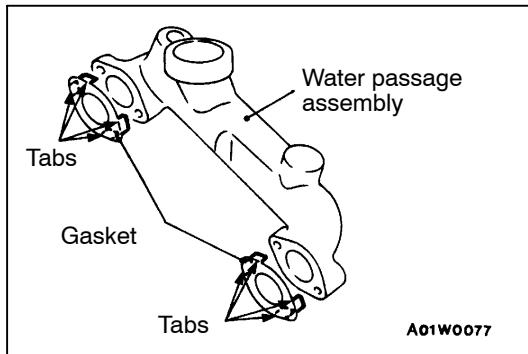
Caution

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◄ 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

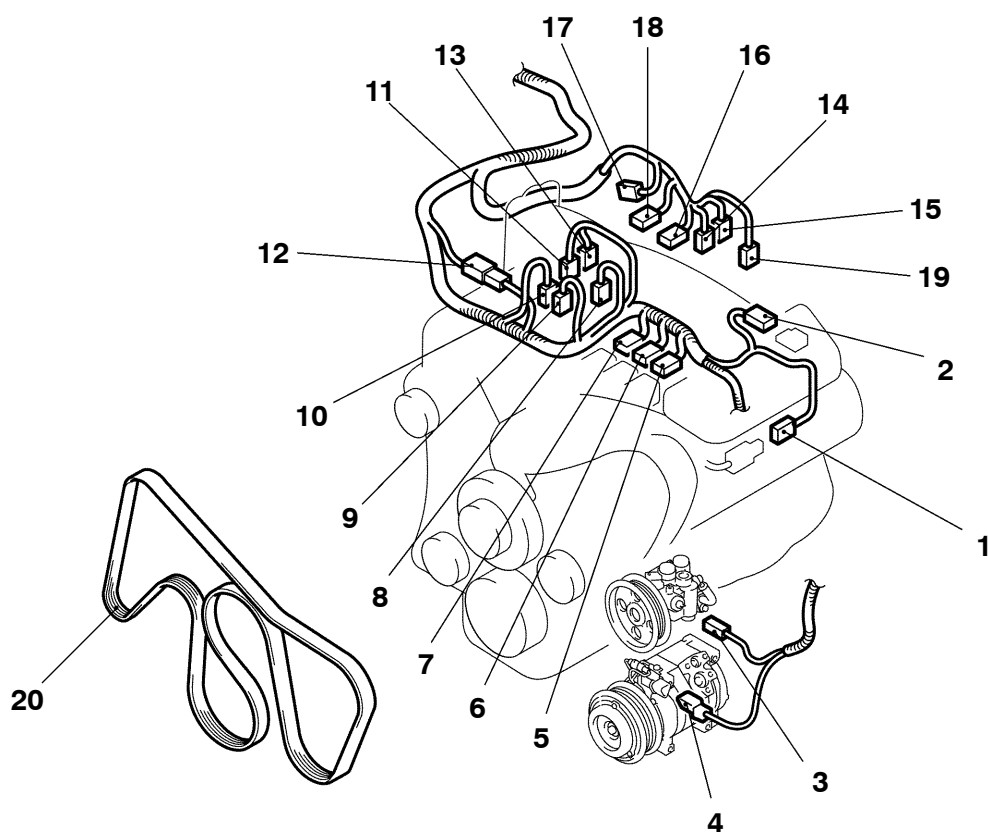
*: Indicates parts which should be initially tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

Pre-removal Operation

- Hood Removal (Refer to GROUP 42 – Hood.)
- Fuel Line Pressure Releasing (Refer to GROUP 13A – On-vehicle Service.)
- Air Cleaner and Air Intake Hose Removal (Refer to GROUP 15 – Air Cleaner.)
- Battery Removal
- Radiator Removal (Refer to GROUP 14 – Radiator.)
- Front Exhaust Pipe Removal (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)
- Transmission Assembly Removal (Refer to GROUP 22 – Transmission Assembly.)

Post-installation Operation

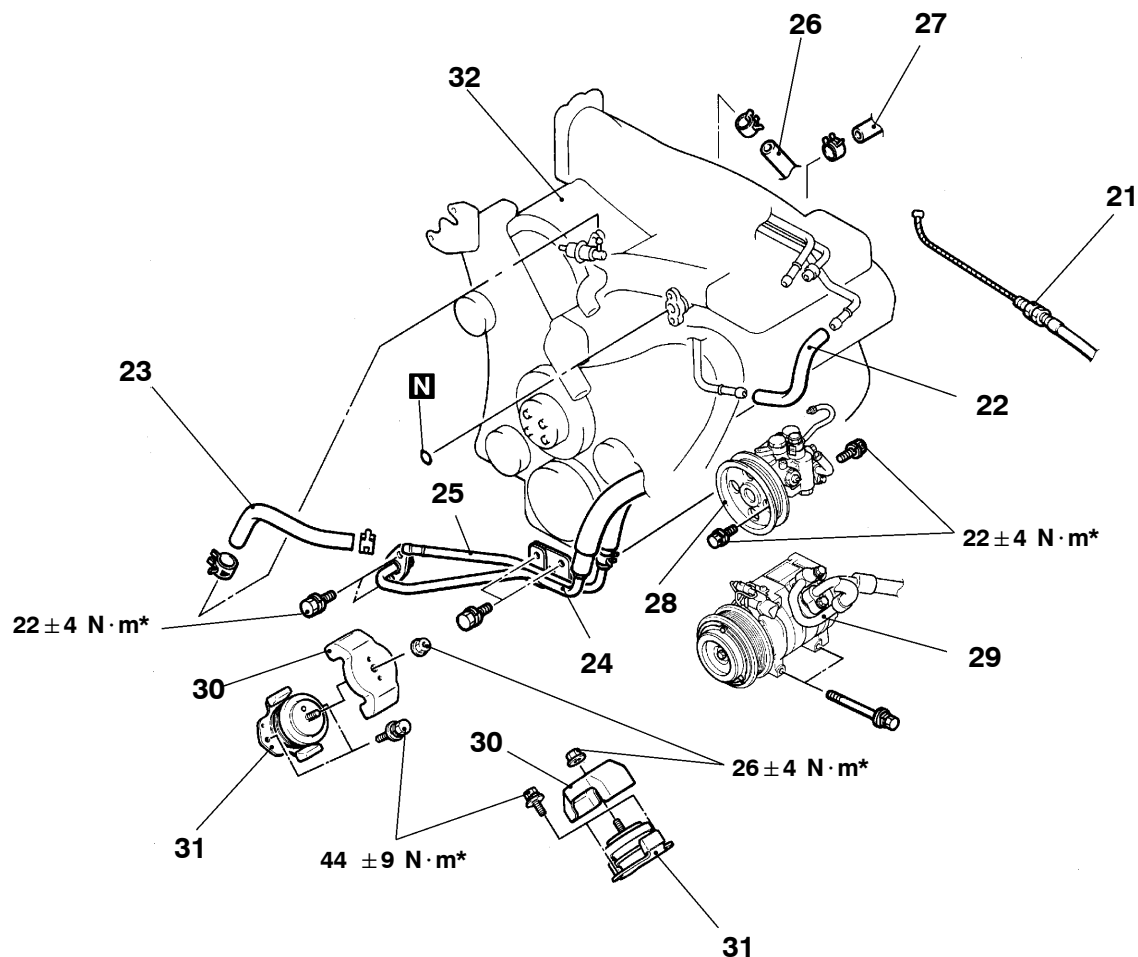
- Transmission Assembly Installation (Refer to GROUP 22 – Transmission Assembly.)
- Front Exhaust Pipe Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)
- Radiator Installation (Refer to GROUP 14 – Radiator.)
- Battery installation
- Air Cleaner and Air Intake Hose Installation (Refer to GROUP 15 – Air Cleaner.)
- Hood Installation (Refer to GROUP 42 – Hood.)
- Drive Belt Tension Check (Refer to P.11B-6.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



AACX01446

Removal steps

- | | |
|--|--|
| 1. Left bank heated oxygen sensor connector <Vehicles for Taiwan> | 11. Ignition power transistor connector |
| 2. Manifold differential pressure sensor connector <Vehicles for Taiwan> | 12. Control wiring harness and injection wiring harness combination connector |
| 3. Power steering oil pressure switch connector | 13. Ignition power transistor connector |
| 4. A/C compressure assembly connector | 14. Control wiring harness and camshaft position sensor wiring harness combination connector |
| 5. Ignition coil 3 connector | 15. Right bank heated oxygen sensor connector <Vehicles for Taiwan> |
| 6. Ignition coil 1 connector | 16. Evaporative emission purge solenoid valve <Vehicles for Taiwan> |
| 7. Ignition coil 2 connector | 17. Throttle position sensor connector |
| 8. Crankshaft position sensor connector | 18. EGR solenoid valve connector |
| 9. Engine coolant temperature sensor connector | 19. Knock sensor connector |
| 10. Engine coolant temperature gauge unit connector | 20. Drive belt |



AACX01630

- 21. Accelerator cable connection
- 22. Vacuum hose connection
- 23. Fuel return hose connection
- 24. High-pressure fuel hose connection
- 25. Fuel pipe
- 26. Heater hose connection



- 27. Heater hose connection
- 28. Power steering oil pump assembly
- 29. A/C compressure assembly
- 30. Heat protector
- 31. Engine front mount insulator
- 32. Engine assembly

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.