
ENGINE <4G6>

CONTENTS

11109000252

GENERAL INFORMATION	2	CRANKSHAFT PULLEY	15
SERVICE SPECIFICATIONS	2	CAMSHAFT AND CAMSHAFT OIL SEAL	16
SEALANTS	4	OIL PAN AND OIL SCREEN	19
SPECIAL TOOLS	4	CRANKSHAFT FRONT OIL SEAL	21
ON-VEHICLE SERVICE	6	CRANKSHAFT REAR OIL SEAL	22
Drive Belt Tension Check and Adjustment	6	CYLINDER HEAD GASKET	24
Ignition Timing Check	8	TIMING BELT	29
Idle Speed Check	9	TIMING BELT B	34
Idle Mixture Check	10	ENGINE ASSEMBLY	37
Compression Pressure Check	10		
Manifold Vacuum Check	12		
Lash Adjuster Check	12		
Lash Adjuster Replacement	14		

GENERAL INFORMATION

11100010179

Items			4G63
Total displacement ml			1,997
Bore × Stroke mm			85.0×88.0
Compression ratio			10.0
Combustion chamber			Pentroof type
Camshaft arrangement			DOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 21°
		Closing	ABDC 51°
	Exhaust	Opening	BBDC 63°
		Closing	ATDC 21°
Fuel system			Electronic control multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

11100030229

Items			Standard value	Limit
Alternator drive belt tension	Tension N	When checked	245–490	—
		When a used belt is installed	392	—
		When a new belt is installed	490–686	—
	Deflection (Reference value) mm	When checked	9.0–11.5	—
		When a used belt is installed	10.0	—
		When a new belt is installed	7.5–9.0	—

Items			Standard value	Limit
Power steering oil pump drive belt tension	Tension N	When checked	245–490	–
		When a used belt is installed	343–441	–
		When a new belt is installed	490–686	–
	Deflection mm	When checked	5.5–8.0	–
		When a used belt is installed	6.0–7.0	–
		When a new belt is installed	4.5–5.5	–
A/C compressor drive belt tension	Tension N	When checked	255–333	–
		When a used belt is installed	255–333	–
		When a new belt is installed	382–441	–
	Deflection mm	When checked	6.5–7.5	–
		When a used belt is installed	6.5–7.5	–
		When a new belt is installed	5.5–6.0	–
Basic ignition timing			5° BTDC±3°	–
Idle speed r/min			850±100	–
CO contents %			0.5 or less	–
HC contents ppm			100 or less	–
Compression pressure (250–400 r/min) kPa			1,350	min. 1,020
Compression pressure difference of all cylinder kPa			–	max. 100
Intake manifold vacuum kPa			min. 60	–
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 mm			3.8–4.5	–
Timing belt B tension mm			5–7	–

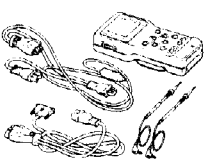
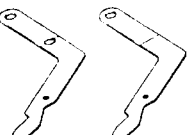
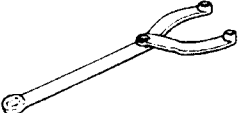
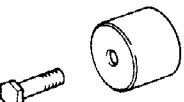
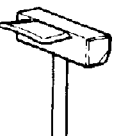
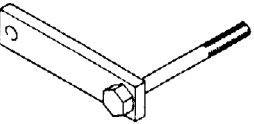
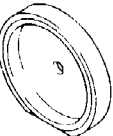
SEALANTS

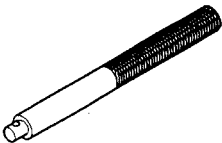
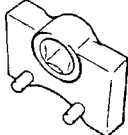
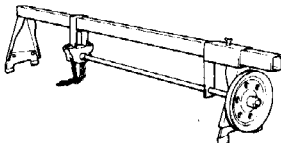
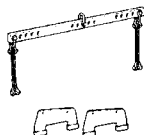
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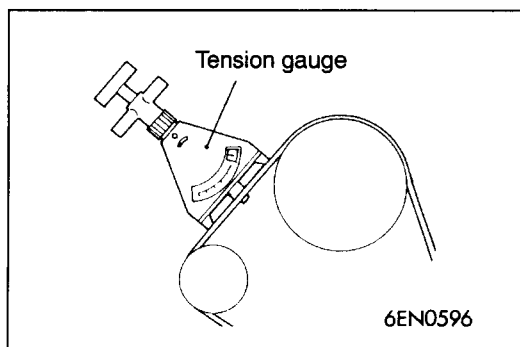
Items	Specified sealant	Remarks
Rocker cover and cylinder head Semi-circular packing	3M ATD Part No. 8660 or equivalent	Semi-drying sealant
Oil pan Thermostat case	MITSUBISHI GENUINE PART MD970389 or equivalent	
Fly wheel bolt	3M Stud locking 4170 or equivalent	

SPECIAL TOOLS

11100060211

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Engine idle speed check Erasing diagnosis code
	MD998782	Valve lifter set	Roller rocker arm removal
	MB990767	End yoke holder	• Holding the camshaft pulley • Holding the crankshaft pulley
	MD998713	Camshaft oil seal installer	Pressing-in camshaft oil seal
	MD998727	Oil pan remover	Oil pan removal
	MD998781	Fly wheel stopper	Securing the flywheel
	MD998776	Crankshaft rear oil seal installer	Press-fitting crankshaft rear oil seal

Tool	Number	Name	Use
	MB990938	Handle	Press-fitting 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
	MB991453	Engine hanger assembly	
	MD998778	Crankshaft sprocket puller	Crankshaft sprocket removal



ON-VEHICLE SERVICE

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DRIVE BELT TENSION CHECK AND ADJUSTMENT

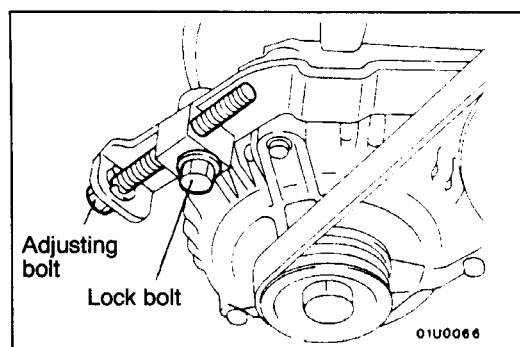
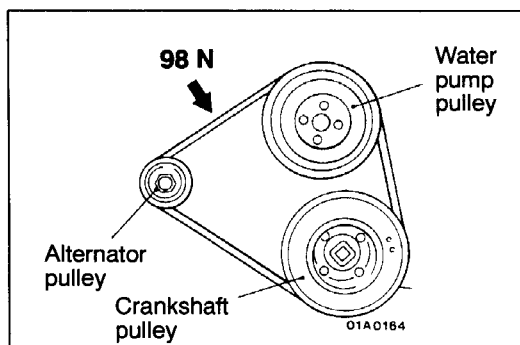
ALTERNATOR DRIVE BELT TENSION CHECK

Use the belt tension gauge to check belt tension at the shown point or check deflection by applying 98 N to the shown point.

Standard value:

Tension: 245 – 490 N

Deflection <Reference value>: 9.0 – 11.5 mm



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the alternator pivot bolt.
2. Loosen the lock bolt.
3. Turn the adjusting bolt to adjust the belt tension or deflection to the standard value.

Standard value:

Items	When a new belt is installed	When a used belt is installed
Tension N	490–686	392
Deflection mm <Reference value>	7.5–9.0	10.0

4. Tighten the nut of the alternator pivot bolt.

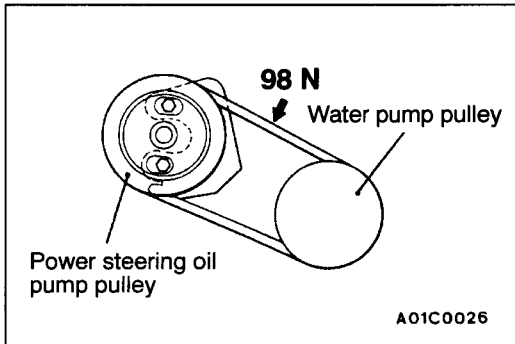
Tightening torque: 22 Nm

5. Tighten the lock bolt.

Tightening torque: 22 Nm

6. Tighten the adjusting bolt.

Tightening torque: 10 Nm



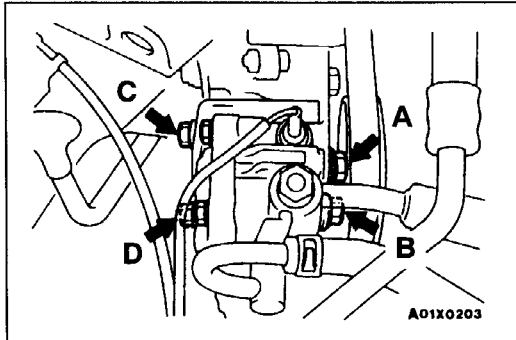
POWER STEERING PUMP DRIVE BELT TENSION CHECK

Use the belt tension gauge to check belt tension at the shown point or check deflection by applying 98 N to the shown point.

Standard value:

Tension: 245 – 490 N

Deflection: 5.5 – 8.0 mm



POWER STEERING PUMP DRIVE BELT TENSION ADJUSTMENT

1. Loosen the power steering pump fixing bolts (A, B, C, D).
2. Move the power steering oil pump, tension belt moderately and adjust the tension.

Standard value:

Items	When a used belt is installed	When a new belt is installed
Tension N	343–441	490–686
Deflection mm	6.0–7.0	4.5–5.5

3. Tighten the fixing bolt (A).

Tightening torque: 28 Nm

4. Tighten the remaining fixing bolts (B, C and D).

Tightening torque:

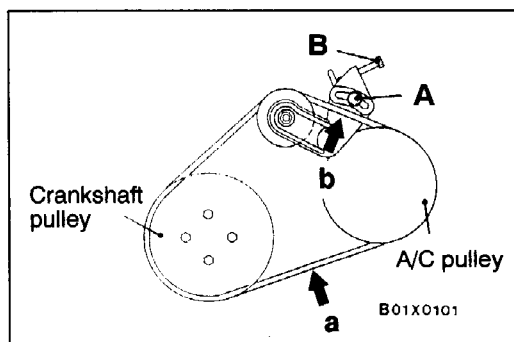
Bolt B and D 28 Nm

Bolt C 22 Nm

5. Check the belt deflection and readjust if necessary.

Caution

This check should be carried out after turning the crankshaft one full rotation or more clockwise (in the forward direction).



A/C COMPRESSOR DRIVE BELT TENSION CHECK

Use the belt tension gauge to check belt tension at the shown point (a) or (b), or check deflection by applying 98 N to the shown point.

Standard value:

Tension: 255 – 333 N

Deflection: 6.5 – 7.5 mm

A/C COMPRESSOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the tension pulley fixing bolt A.
2. Adjust the belt tension with the adjusting bolt B.

Standard value:

Items	When a used belt is installed	When a new belt is installed
Tension N	255–333	382–411
Deflection mm	6.5–7.5	5.5–6.0

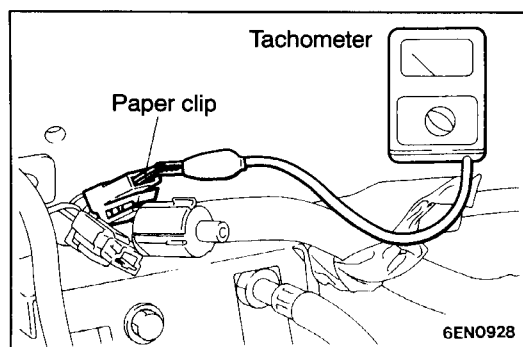
3. Tighten the fixing nut A.

Tightening torque: 23–26 Nm

4. Check the belt deflection and readjust if necessary.

Caution

This check should be carried out after turning the crankshaft one full rotation or more clockwise (in the forward direction).

**IGNITION TIMING CHECK**

11100170099

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Insert a paper clip from the harness side into the 1-pin connector (blue) as shown in the illustration at left.
3. Connect a primary-voltage-detection type of tachometer to the paper clip.

NOTE

Do not use the MUT-II.

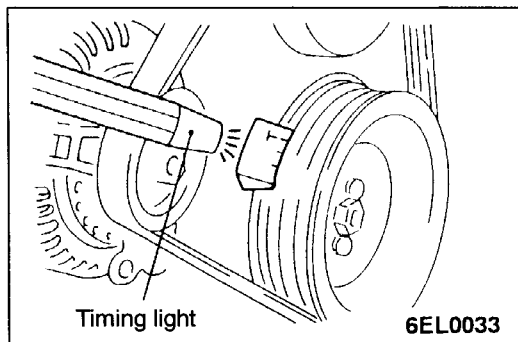
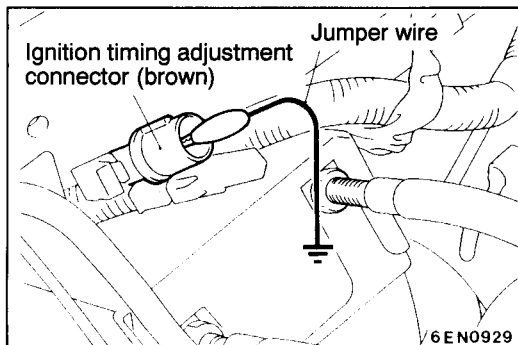
If tested with the MUT-II connected to the diagnosis connector, the ignition timing will not be the basic timing but be ordinary timing.

4. Set up a timing light
5. Start the engine and run at idle.
6. Check that engine idle speed is within the standard value.

Standard value: 850 ± 100 r/min**NOTE**

For r/min, one-half of the actual engine r/min is indicated, so the actual engine r/min is two times the indicated value shown by the tachometer.

7. Turn off the ignition switch.
8. Remove the waterproof connector from the ignition timing adjustment connector (brown).



9. Connect the jumper wire with the clip to the ignition timing adjustment terminal, and ground this to the body as illustrated.

NOTE

Grounding this terminal sets the engine to the basic ignition timing.

10. Start the engine and run it at idle.
11. Check that basic ignition timing is within the standard value.
12. If the basic ignition timing is outside the standard value, check the MPI components by referring to GROUP 13A – Troubleshooting.
13. Stop the engine, remove the jumper wire from the ignition timing adjustment connector (brown), and return the connector to its original condition.
14. Start the engine and check that the actual ignition timing is at the standard value.

Standard value: Approx. 8° BTDC

NOTE

1. Ignition timing is variable within about $\pm 7^\circ$, even under normal operating.
2. In addition, it is automatically further advanced by about 5° from 8° BTDC at higher altitudes.

IDLE SPEED CHECK

11100190194

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Check the basic ignition timing.
3. Turn off the ignition switch before connecting or disconnecting the MUT-II.
4. Start the engine and run it at idle.
5. Run the engine at idle for 2 minutes.
6. Check the idle speed.

Standard value: 850 $\pm$ 100 r/min

NOTE

The idle speed is controlled automatically by the idle air control system.

7. If the idle speed is outside the standard value, check the MPI components by referring to GROUP 13A – Troubleshooting.

IDLE MIXTURE CHECK

1100210166

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Check that the basic ignition timing is within the standard value.

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

3. Turn off the ignition switch before connecting or disconnecting the MUT-II.
4. Start the engine and run it at 2,500 r/min for 2 minutes.
5. Set the CO, HC tester.
6. Check the CO contents and the HC contents at idle.

Standard value:**CO contents: 0.5% or less****HC contents: 100 ppm or less**

7. If the idle speed is outside the standard value, check the following items:
 - Diagnosis output
 - Closed-loop control (When the closed-loop control is carried out normally, the output signal of the oxygen sensor repeats between 0–400 mV and 600–1,000 mV at idle.)
 - Fuel pressure
 - Injector
 - Ignition coil, spark plug cable, spark plug
 - EGR system and the EGR valve leak
 - Evaporative emission control system
 - Compression pressure

NOTE

Replace the three-way catalyst whenever the CO and HC contents do not remain inside the standard value. (even though the result of the inspection is normal on all items).

COMPRESSION PRESSURE CHECK

11100260192

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.

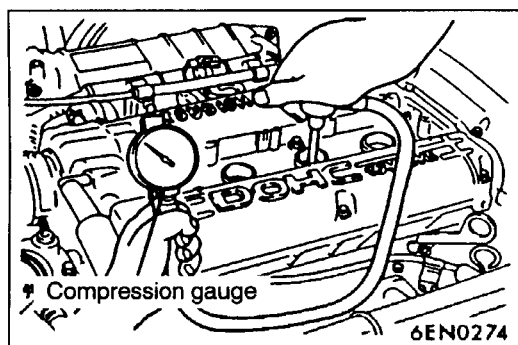
NOTE

Doing this will prevent the engine control unit 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):
1,350 kPa

Limit (at engine speed of 250–400 r/min):
min. 1,020 kPa

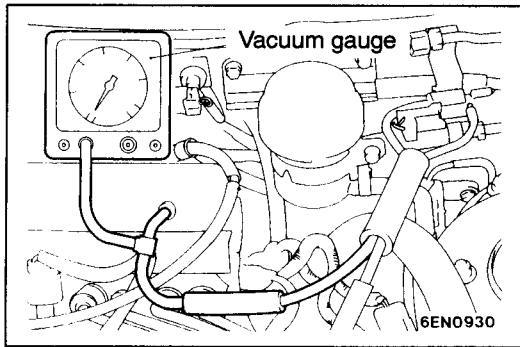
8. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

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.

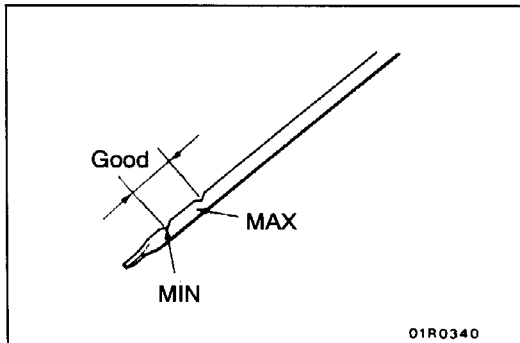
NOTE

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

**MANIFOLD VACUUM CHECK**

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1. Start the engine and allow it to warm up until the temperature of the engine coolant reaches 80 to 95°C.
2. Connect a tachometer.
3. Attach a three-way union to the vacuum hose between the fuel pressure regulator and the air intake plenum, and connect a vacuum gauge.
4. Start the engine and check that idle speed is within specification. Then read off the vacuum gauge.

Standard value: min. 60 kPa**LASH ADJUSTER CHECK**

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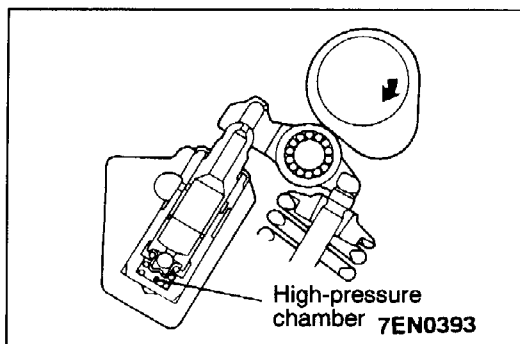
NOTE

If an abnormal noise (rattling noise) probably caused by the lash adjusters is heard and the noise does not stop, check as follows.

1. Check the engine oil, and if required, refuel or replace it.

NOTE

- If the amount of the engine oil is insufficient, air will be sucked in from the oil strainer and mix in the oil passage.
- If the amount of the engine oil is more than the specified amount, it will be stirred by the crankshaft to make a lot of air mix in the oil.
- If the oil is deteriorated, it will not easily separate from air and the amount of air mixed in the oil will increase.



If the air which has mixed in the oil due to the above causes enters the high-pressure chamber in the lash adjusters, the air in the high pressure chamber will be pressurized during opening of the valve, which causes the lash adjusters to shrink excessively, and an abnormal noise will be generated when the valve is closed. This is the same phenomenon as the one when the valve clearance has been excessively adjusted by mistake. In this case, if the air which has entered the lash adjusters is bled, things will be normalized.

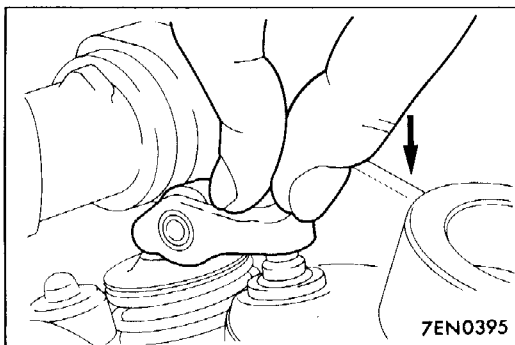
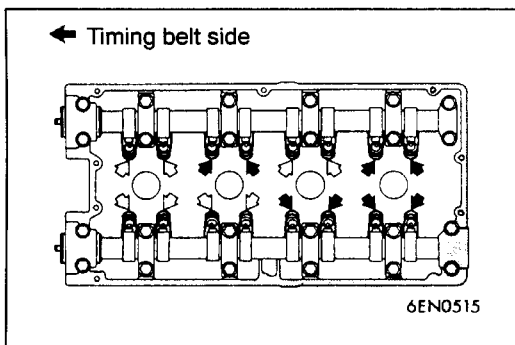
2. Start the engine and perform gentle racing* several times (less than 10 times.)

If the abnormal noise stops by racing, the air is bled from the high-pressure chamber of the lash adjusters and the function of the lash adjusters is normalized.

*: After raising the engine speed from idling to 3,000 r/min gradually (in 30 seconds), drop the speed gradually (in 30 seconds) to idling.

NOTE

- If the vehicle is parked on a slope for long, the oil in the lash adjusters will be decreased and air may enter the high-pressure chamber when the vehicle is started.
- After the vehicle is parked for long, air may enter the high pressure chamber because the oil in the oil passage will be gone and it will take a time before the oil is supplied to the lash adjusters.



3. If an abnormal noise does not stop by racing, check the lash adjusters according to the following procedures.

- (1) Stop the engine.
- (2) Set the No. 1 cylinder of the engine to the compression top dead center.
- (3) Push the rocker arm indicated by the white arrow mark as shown in the illustration at left and check whether or not the arm lock goes down.
- (4) Turn slowly the crankshaft 360° clockwise.
- (5) Check the rocker arm indicated by the black arrow mark as shown in the illustration at left same as above (3).

- (6) If the rocker arm can be lowered easily when the part of the rocker arm which is directly above the top of the lash adjuster is pressed, the lash adjuster is defective and should be replaced with a new part. In the same procedure as step 4, replace the lash adjuster.

Furthermore, when replacing the lash adjuster, bleed all of the air from the lash adjuster and then install. After this, check that there is no problem by checking in steps (1) to (5).

NOTE

- A leak-down test can be carried out to accurately determine whether the lash adjuster is defective or not.
- For the procedures for the leak-down test and air bleeding of the lash adjuster, refer to P.9A-52.

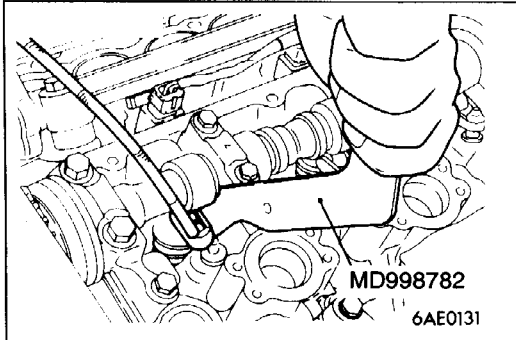
Furthermore, if the rocker arm feels extremely stiff and cannot be lowered when it is pressed, the lash adjuster is normal, so check for some other cause of the abnormality.

4. Lash adjuster replacement procedure.

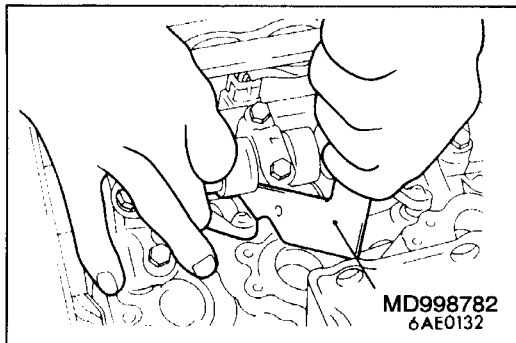
Caution

In the cylinder which are being removed, the valves will touch the pistons when the valves are pushed down, so the crankshaft should be turn to lower the piston positions.

In addition, places where the rocker arms are lifted by the cams cannot be removed. In these cases, the crankshaft should be turned so that the rocker arms are not lifted.



- (1) Use the special tool to push down the valve, and remove the roller rocker arm.
- (2) Remove the lash adjuster from the cylinder head.
- (3) Install a new lash adjuster from which the air has been bled to the cylinder head.



- (4) Use the special tool to push down the valve, and install the roller rocker arm.

NOTE

When installing the roller rocker arm, first set the pivot side of the rocker arm onto the top of the lash adjuster, and then after pushing down the valve, set the slipper side of the rocker arm on top of the end of the valve stem.

LASH ADJUSTER REPLACEMENT

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Refer to LASH ADJUSTER CHECK.

CRANKSHAFT PULLEY

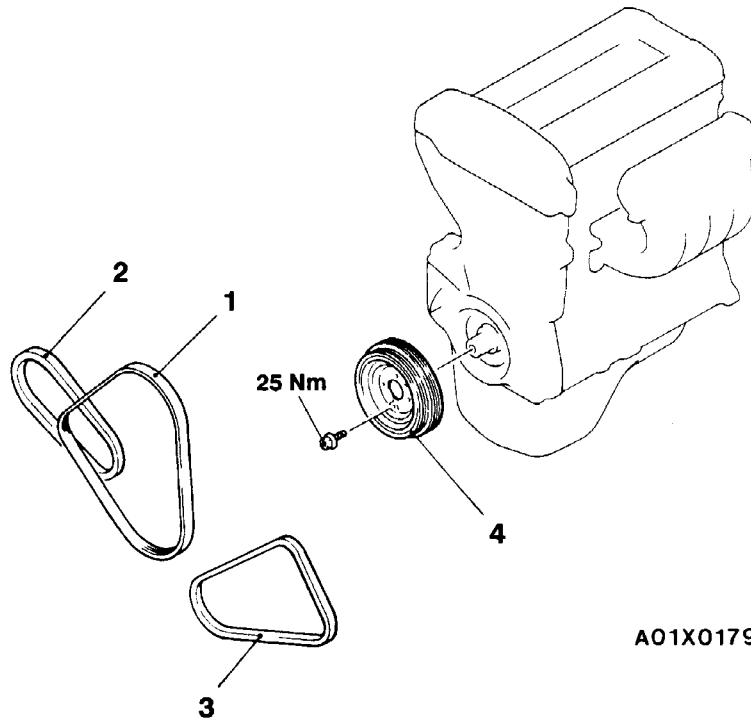
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REMOVAL AND INSTALLATION**Pre-removal Operation**

- Under Cover Removal

Post-installation Operation

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



A01X0179

Removal steps

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

CAMSHAFT AND CAMSHAFT OIL SEAL

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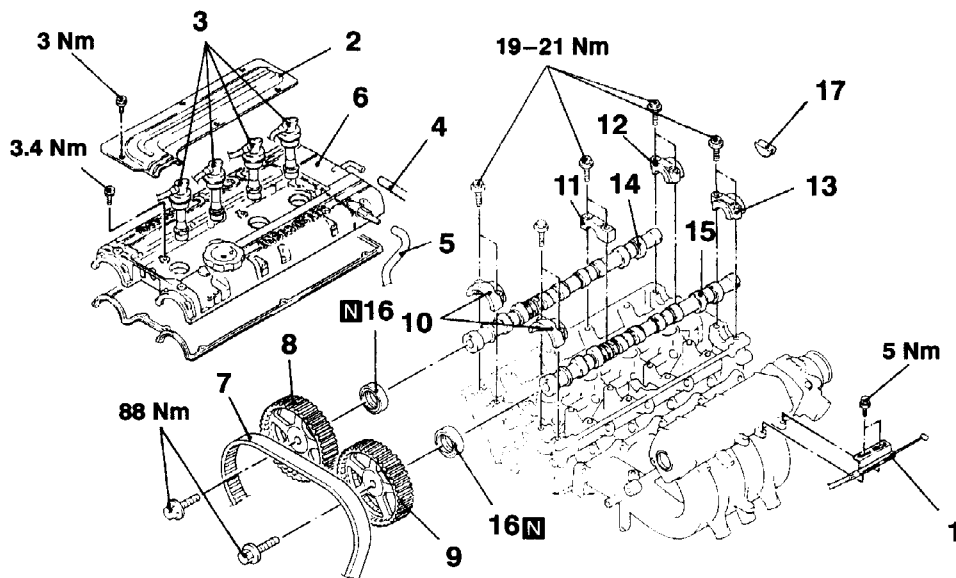
REMOVAL AND INSTALLATION

Pre-removal Operation

- Timing Belt Front Upper Cover Removal (Refer to P.11A-29.)

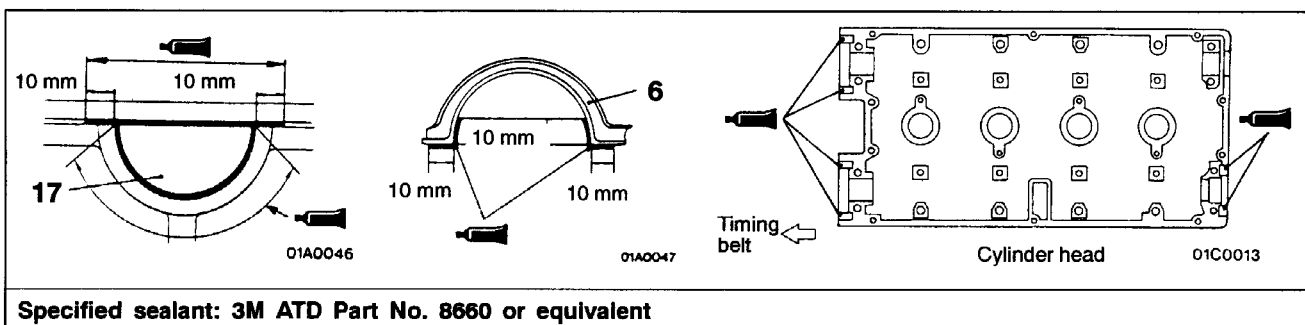
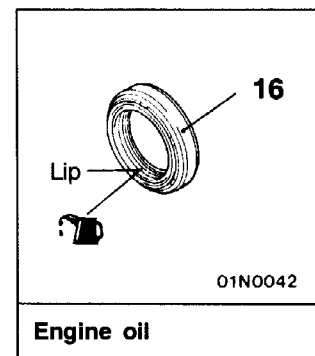
Post-Installation Operation

- Timing Belt Front Upper Cover Installation (Refer to P.11A-29.)



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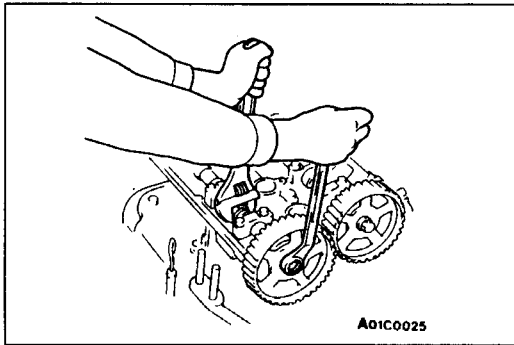
Specified sealant: 3M ATD Part No. 8660 or equivalent

Removal steps

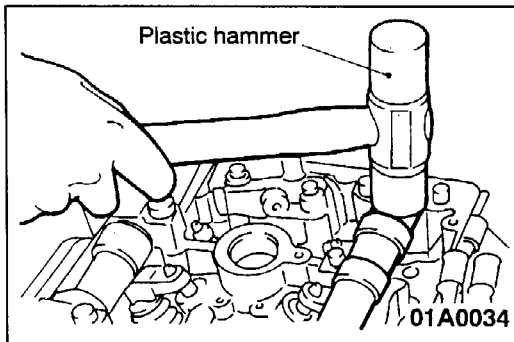
1. Accelerator cable connection
2. Center cover
3. Spark plug cable
4. Breather hose
5. PCV hose
6. Rocker cover
7. Timing belt (Refer to P.11A-29.)
8. Exhaust camshaft sprocket
9. Intake camshaft sprocket
10. Front camshaft bearing cap
11. Camshaft bearing cap
12. Rear camshaft bearing cap (R.H.)
13. Rear camshaft bearing cap (L.H.)
14. Exhaust camshaft
15. Intake camshaft
16. Camshaft oil seal
17. Semi-circular packing

Installation steps

- ▶A▶ 15. Intake camshaft
- ▶A▶ 14. Exhaust camshaft
- ▶B▶ 13. Rear camshaft bearing cap (R.H.)
- ▶B▶ 12. Rear camshaft bearing cap (L.H.)
- ▶B▶ 11. Camshaft bearing cap
- ▶B▶ 10. Front camshaft bearing cap
- ▶C▶ 16. Camshaft oil seal
9. Intake camshaft sprocket
8. Exhaust camshaft sprocket
7. Timing belt (Refer to P.11A-29.)
17. Semi-circular packing
6. Rocker cover
5. PCV hose
4. Breather hose
3. Spark plug cable
2. Center cover
1. Accelerator cable connection (Refer to GROUP 17 – On-vehicle Service.)

**REMOVAL SERVICE POINTS****◀A▶ EXHAUST CAMSHAFT SPROCKET/INTAKE CAMSHAFT SPROCKET REMOVAL**

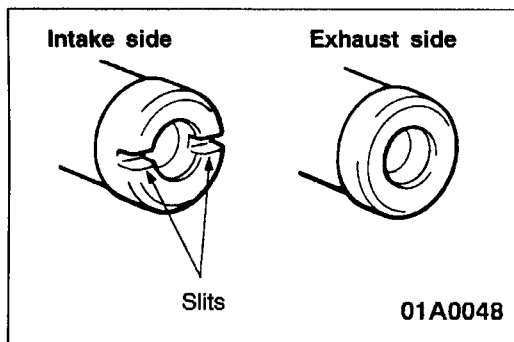
- (1) Use a wrench at the hexagonal part of the camshaft (to prevent the crankshaft from turning) to loosen the camshaft sprocket bolt.
- (2) Remove the camshaft sprockets.

**◀B▶ FRONT CAMSHAFT BEARING CAP/CAMSHAFT BEARING CAP/REAR CAMSHAFT BEARING CAP (R.H.)/REAR CAMSHAFT BEARING CAP (L.H.) REMOVAL**

- (1) Loosen the bearing cap installation bolts in two or three steps.
- (2) Remove the bearing cap.

NOTE

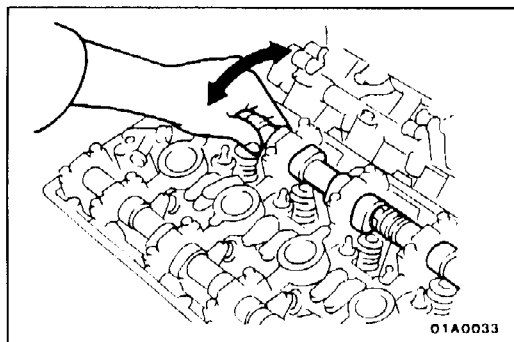
If the bearing cap is difficult to remove, use a plastic hammer to gently tap the rear part of the camshaft, and then remove.

**INSTALLATION SERVICE POINTS****▶A◀ INTAKE CAMSHAFT/EXHAUST CAMSHAFT INSTALLATION**

- (1) Install the camshafts on the cylinder head.

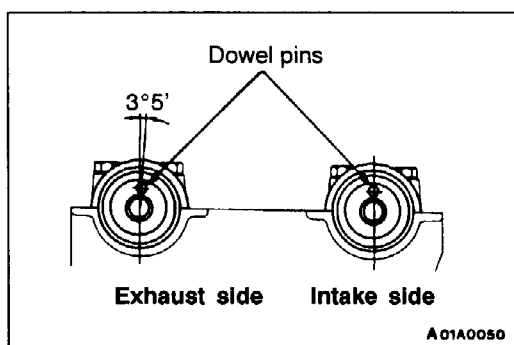
Caution

Do not confuse the intake side and the exhaust side.

**NOTE**

Install new camshafts using the following procedure.

- (1) Remove the rocker arms.
- (2) Lay the camshafts on the cylinder head and install the bearing caps.
- (3) Check that the camshaft can be easily turned by hand.
- (4) After checking, remove the bearing caps and the camshafts, and install the rocker arms.



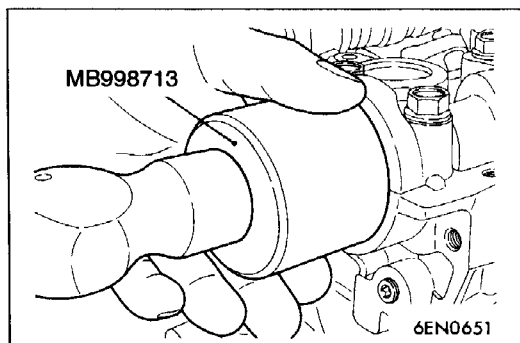
- (2) The camshaft's dowel pins should be at the positions shown in the figure.

►B◄ REAR CAMSHAFT BEARING CAP (R.H.)/REAR CAMSHAFT BEARING CAP (L.H.)/CAMSHAFT BEARING CAP/FROM CAMSHAFT BEARING CAP INSTALLATION

Tighten the bearing cap installation bolts to the specified torque in two or three steps.

Caution

Tighten uniformly, otherwise the rocker arms will not be straight.



►C◄ CAMSHAFT OIL SEAL INSTALLATION

Use the special tool to drive the camshaft oil seal into position carefully.

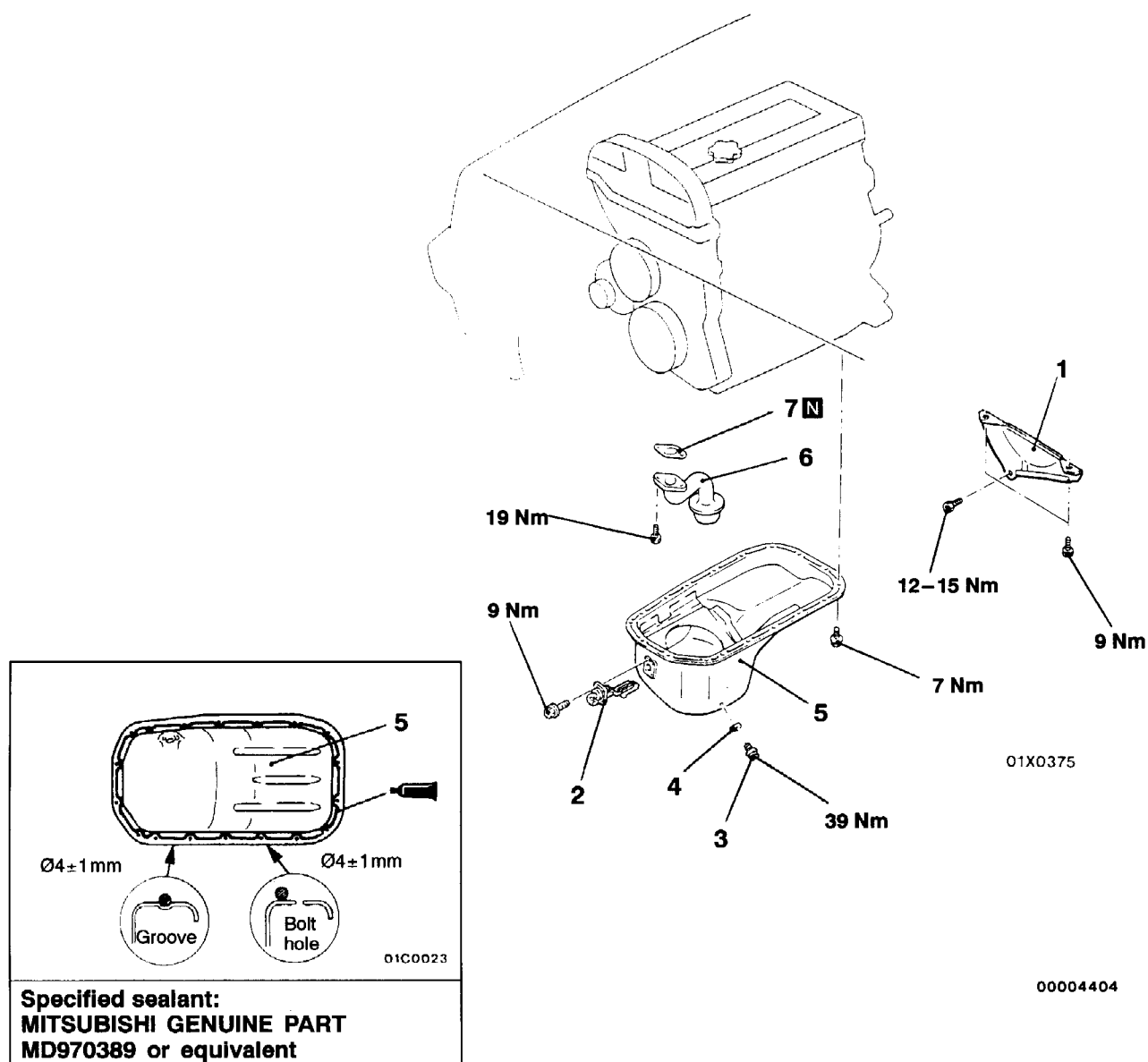
OIL PAN AND OIL SCREEN

11200250161

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

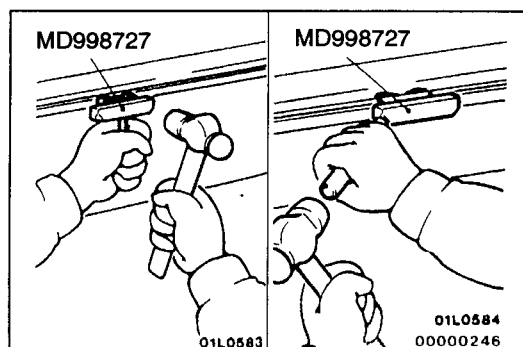
- (1) Engine Oil Draining and Supplying
- (2) Oil Level Gauge Removal and Installation
- (3) Front Exhaust Pipe Removal and Installation
(Refer to GROUP 15.)

**Removal steps**

1. Bell housing cover
2. Engine oil level sensor
3. Drain plug
4. Gasket



5. Oil pan
6. Oil screen
7. Gasket

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

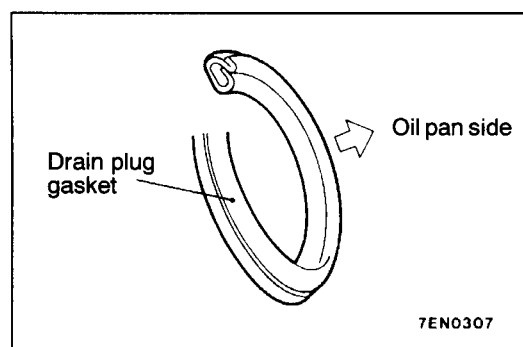
After removing the oil pan mounting bolts, remove the oil pan with the special tool and a brass bar.

Caution

Do it slowly to avoid deformation of the oil pan flange.

INSTALLATION SERVICE POINTS**▶A◀ OIL PAN INSTALLATION****Caution**

After cleaning the oil pan mounting bolt holes in the oil seal case, the oil pan should be installed.

**▶B◀ GASKET INSTALLATION**

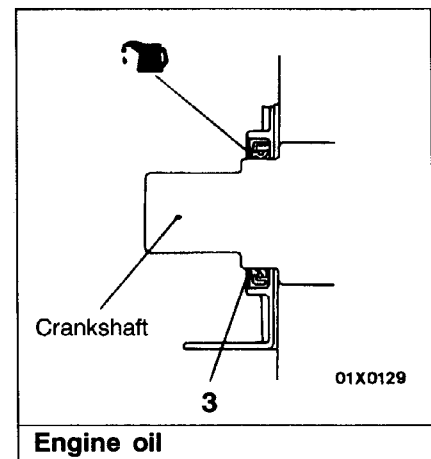
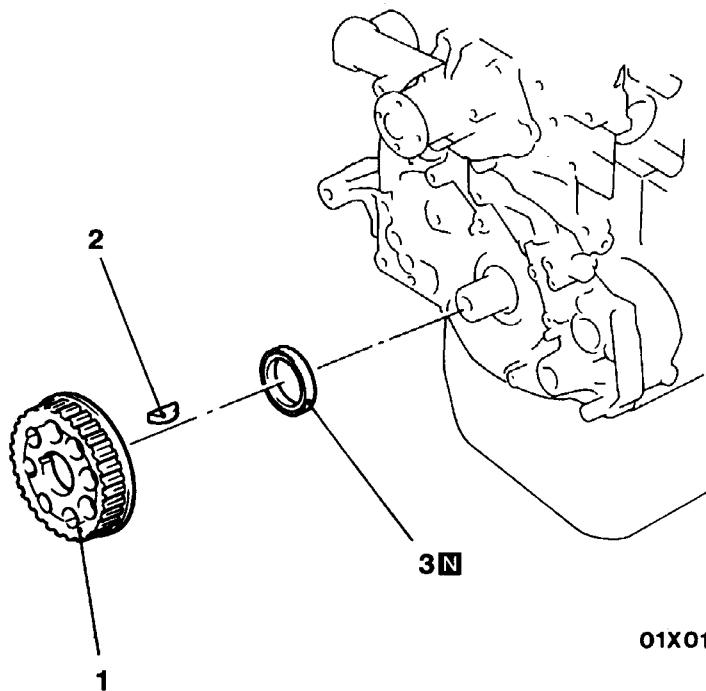
Replace the gasket and install it in the direction shown in the illustration.

CRANKSHAFT FRONT OIL SEAL REMOVAL AND INSTALLATION

11200340202

Pre-removal and Post-installation Operation

- Timing Belt B Removal and Installation
(Refer to P.11A-34.)

**Removal steps**

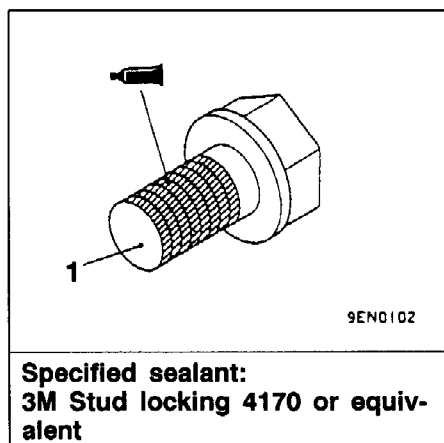
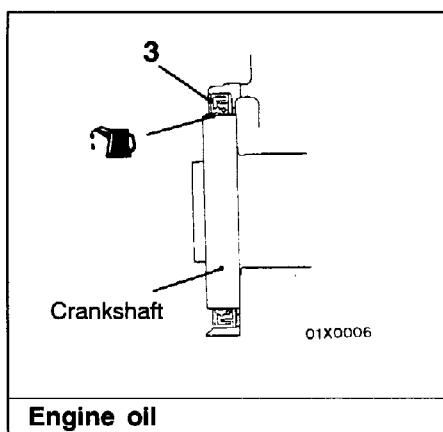
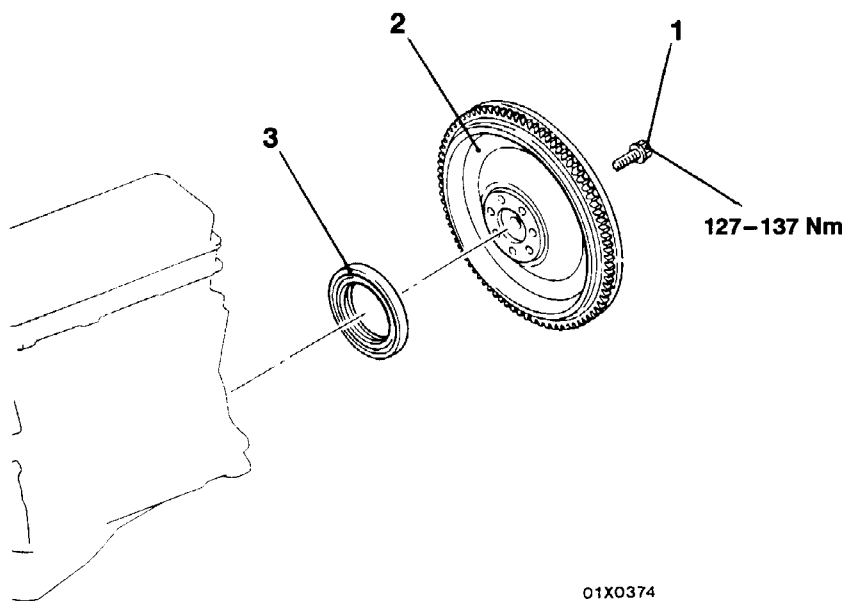
1. Crankshaft sprocket B
2. Key
3. Crankshaft front oil seal

**INSTALLATION SERVICE POINT****▶◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION**

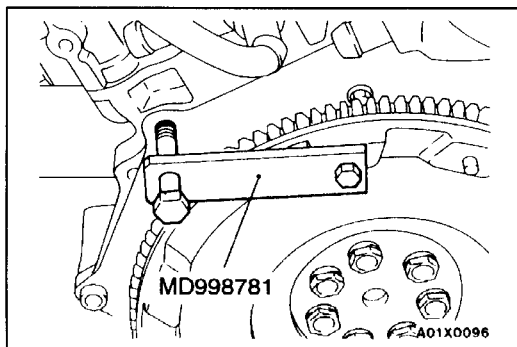
- (1) Apply engine oil to the entire inside diameter of the oil seal lip.
- (2) Press-fit the oil seal until it is flush with the oil pump case.

CRANKSHAFT REAR OIL SEAL**REMOVAL AND INSTALLATION****Pre-removal and Post-Installation Operation**

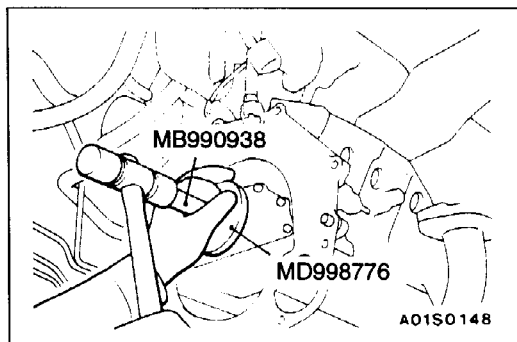
- (1) Transmission Assembly Removal and Installation
(Refer to GROUP 22.)
- (2) Clutch Cover and Clutch Disc Removal and Installation

**Removal steps**

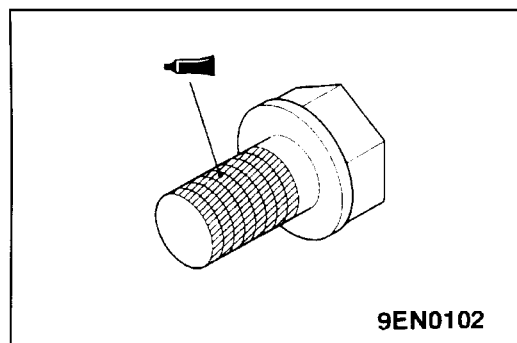
- ◀A▶ ▶B▶ 1. Flywheel bolt
 ▶A▶ 2. Flywheel
 ▶A▶ 3. Crankshaft rear oil seal

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

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

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

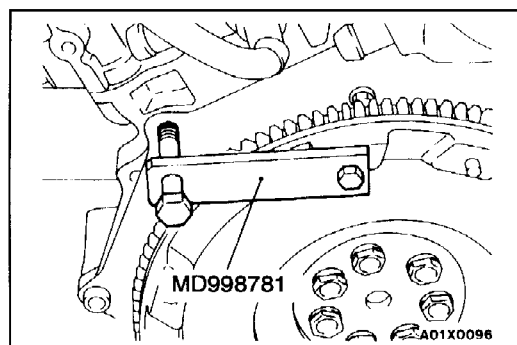
- (1) Apply a small amount of engine oil to the entire inside diameter of the oil seal lip.
- (2) Tap in the oil seal as shown in the illustration.

**▶B◀ FLYWHEEL BOLT INSTALLATION**

- (1) Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel.
- (2) Apply oil to the bearing surface of the flywheel bolt.
- (3) Apply oil to the crankshaft thread holes.
- (4) Apply sealant to the threaded mounting bolts.

Specified sealant:

3M Stud locking 4170 or equivalent



- (5) Use the special tool to secure the flywheel and then tighten the bolts to the specified torque.

Tightening torque: 127–137 Nm

CYLINDER HEAD GASKET

11200400252

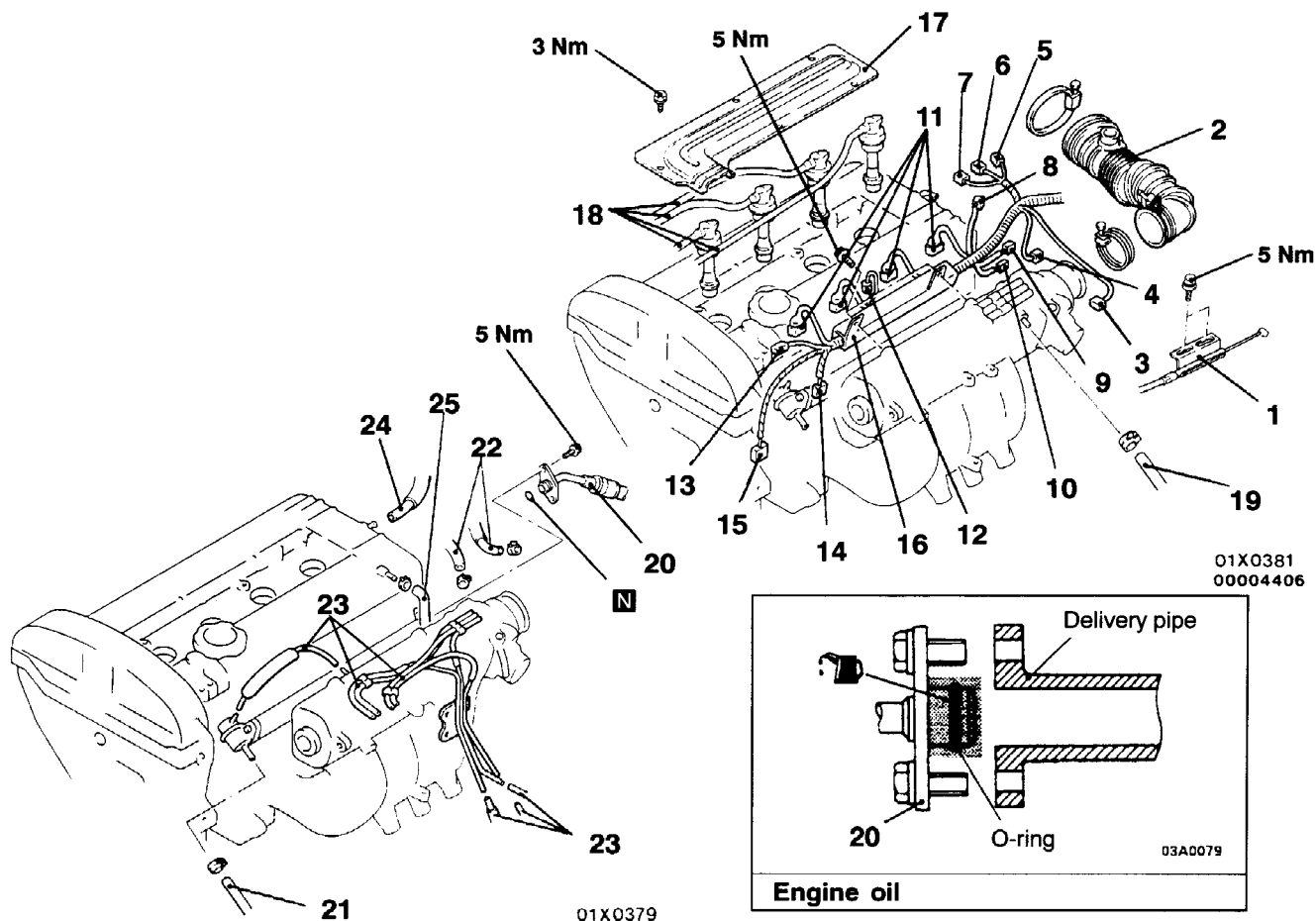
REMOVAL AND INSTALLATION

Pre-removal Operation

- (1) Fuel Line Inner Pressure Release
(Refer to GROUP 13A–On-vehicle Service.)
- (2) Engine Coolant Draining
(Refer to GROUP 14 – On-vehicle Service.)
- (3) Engine Oil Draining
(Refer to GROUP 12 – On-vehicle Service.)

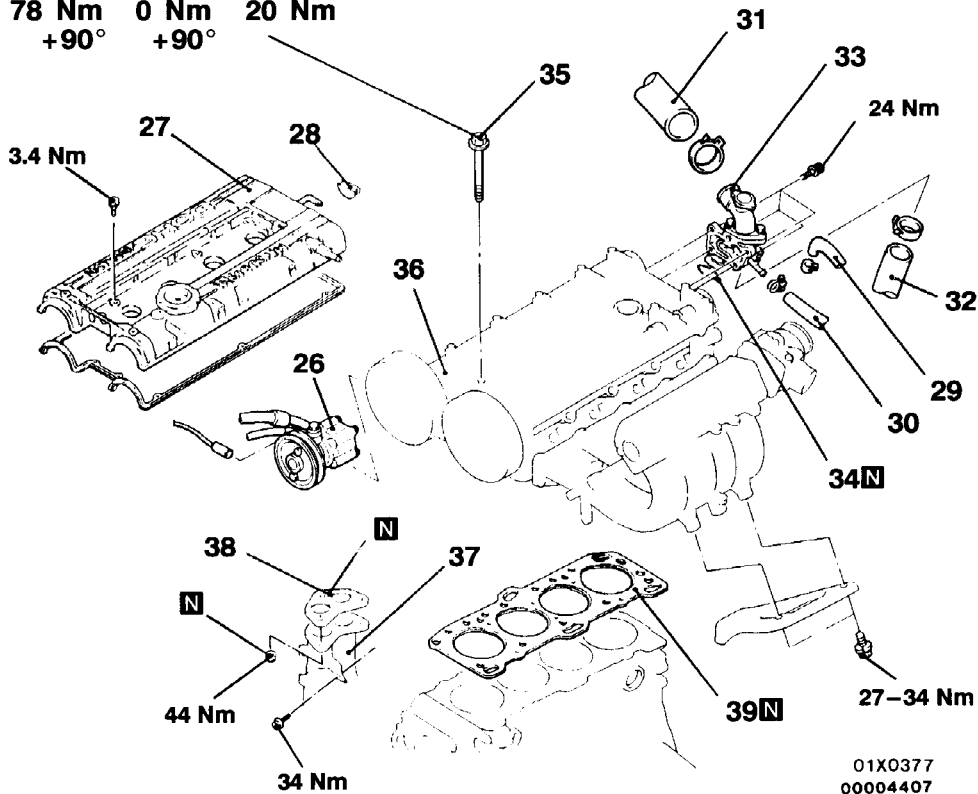
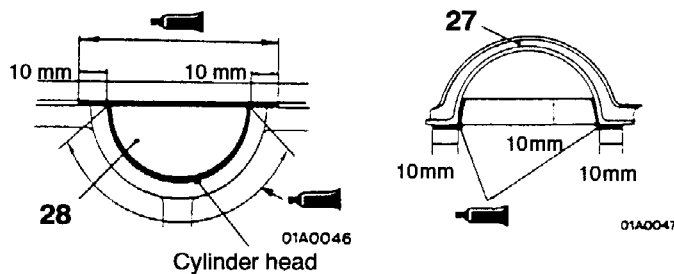
Post-installation Operation

- (1) Engine Oil Refilling
(Refer to GROUP 12 – On-vehicle Service.)
- (2) Engine Coolant Refilling
(Refer to GROUP 14 – On-vehicle Service.)

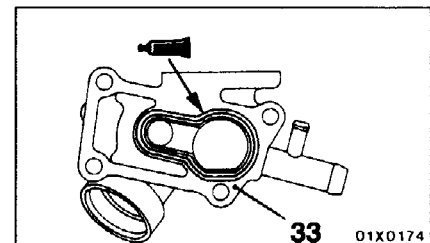
**Removal steps**

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Accelerator cable connection
(Refer to GROUP 17 – On-vehicle Service.) 2. Air intake hose 3. ISC connector 4. Detonation sensor connector 5. Oxygen sensor connector 6. Engine coolant temperature gauge unit connector 7. Engine coolant temperature sensor connector 8. Power transistor connector 9. Throttle position sensor connector 10. Capacitor connector 11. Injector connectors 12. Ignition coil connector | <ol style="list-style-type: none"> 13. Camshaft position sensor connector 14. Crankshaft position sensor connector 15. A/C compressor connector 16. Control wiring harness 17. Center cover 18. Spark plug cable 19. Brake booster vacuum hose connection ▶F◀ 20. High-pressure fuel hose connection 21. Fuel return hose connection 22. Water hose connection 23. Vacuum hoses connection 24. Breather hose connection 25. PCV hose connection |
|--|--|

<Cold engine>

78 Nm 0 Nm 20 Nm
+90° +90°01X0377
00004407

Sealant: 3M ATD Part No. 8660 or equivalent

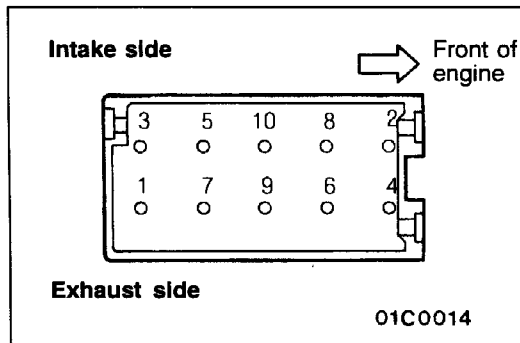
Specified sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent

- Timing belt
(Refer to P.11A-29.)
- 26. Power steering oil pump
- 27. Rocker cover
- 28. Semi-circular packing
- 29. Water hose connection
- 30. Heater hose
- 31. Radiator upper hose connection

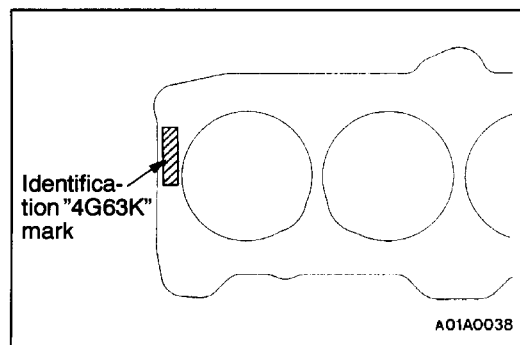
- ◀A▶ ▶E▶ 32. Radiator lower hose connection
- ▶D▶ 33. Thermostat case assembly
- ▶C▶ 34. O-ring
- ▶B▶ 35. Cylinder head bolt
- ▶A▶ 36. Cylinder head assembly
- ▶A▶ 37. Front exhaust pipe connection
- ▶A▶ 38. Gasket
- ▶A▶ 39. Cylinder head gasket

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

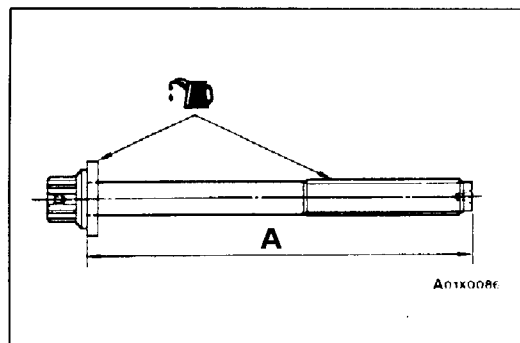
Place mating marks on the radiator hose and the hose clamp, and then disconnect the radiator hose.

**◀B▶ CYLINDER HEAD BOLT REMOVAL**

Loosen the bolts in the order shown in the illustration (in 2 or 3 stages), and then remove the cylinder head assembly.

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

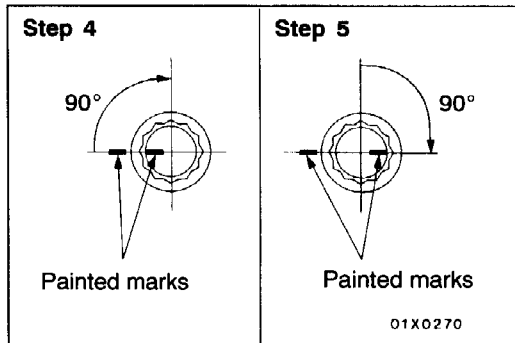
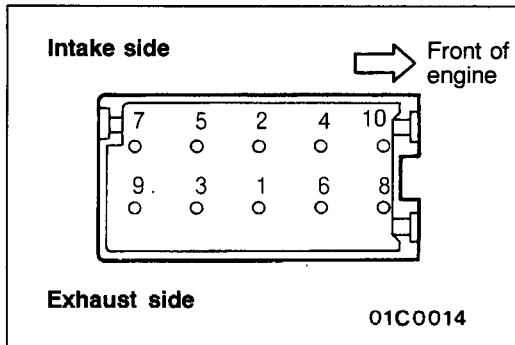
- (1) Wipe off all oil and grease from the gasket mounting surface.
- (2) Install the gasket to the cylinder block with the identification mark facing upwards.

**▶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) Apply engine oil to the bolt thread and the washer.

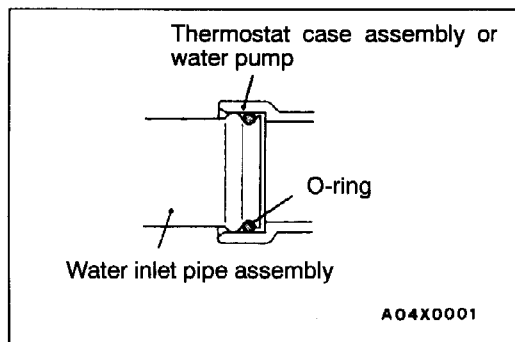


(3) Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 78 Nm.	In the order shown in the illustration.
2	Loosen fully.	In the reverse order of that shown in the illustration.
3	Tighten to 20 Nm.	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.

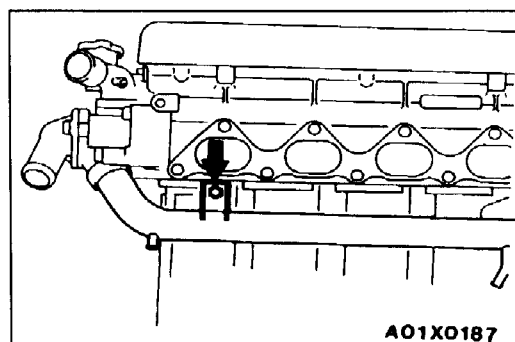


►◄ O-RING INSTALLATION

Insert the O-ring to the water inlet pipe, and coat the outer inside diameter of the O-ring with water or engine coolant.

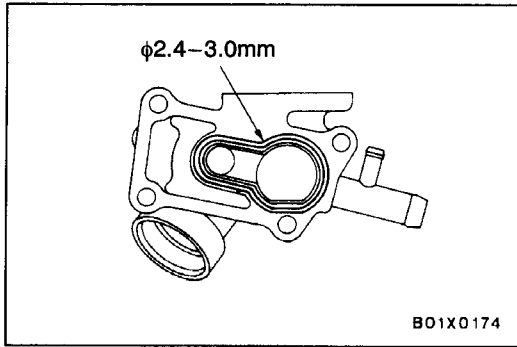
Caution

Do not let engine oil or other greases contact with the O-ring.



►◄ THERMOSTAT CASE ASSEMBLY INSTALLATION

- (1) Loosen the water inlet pipe bolt shown in the illustration.



- (2) Apply specified sealant to the thermostat case assembly in the places shown in the illustration.

Specified sealant:

MITSUBISHI GENUINE PART MD970389 or equivalent

- (3) Apply a small amount of water to the O-ring of the water inlet pipe, and then press the thermostat case assembly into the water inlet pipe.
- (4) Tighten the thermostat case assembly mounting bolts.
- (5) Tighten the water inlet pipe bolts.

►E◄ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

- (1) Insert each hose as far as the projection of the water outlet fitting or water inlet fitting.
- (2) Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

►F◄ HIGH-PRESSURE FUEL HOSE CONNECTION

When connecting the high-pressure fuel hose to the delivery pipe, apply a small amount of clean engine oil to the hose union and then insert, being careful not to damage the O-ring.

Caution

Do not let engine oil get into the delivery pipe.

TIMING BELT

11200430244

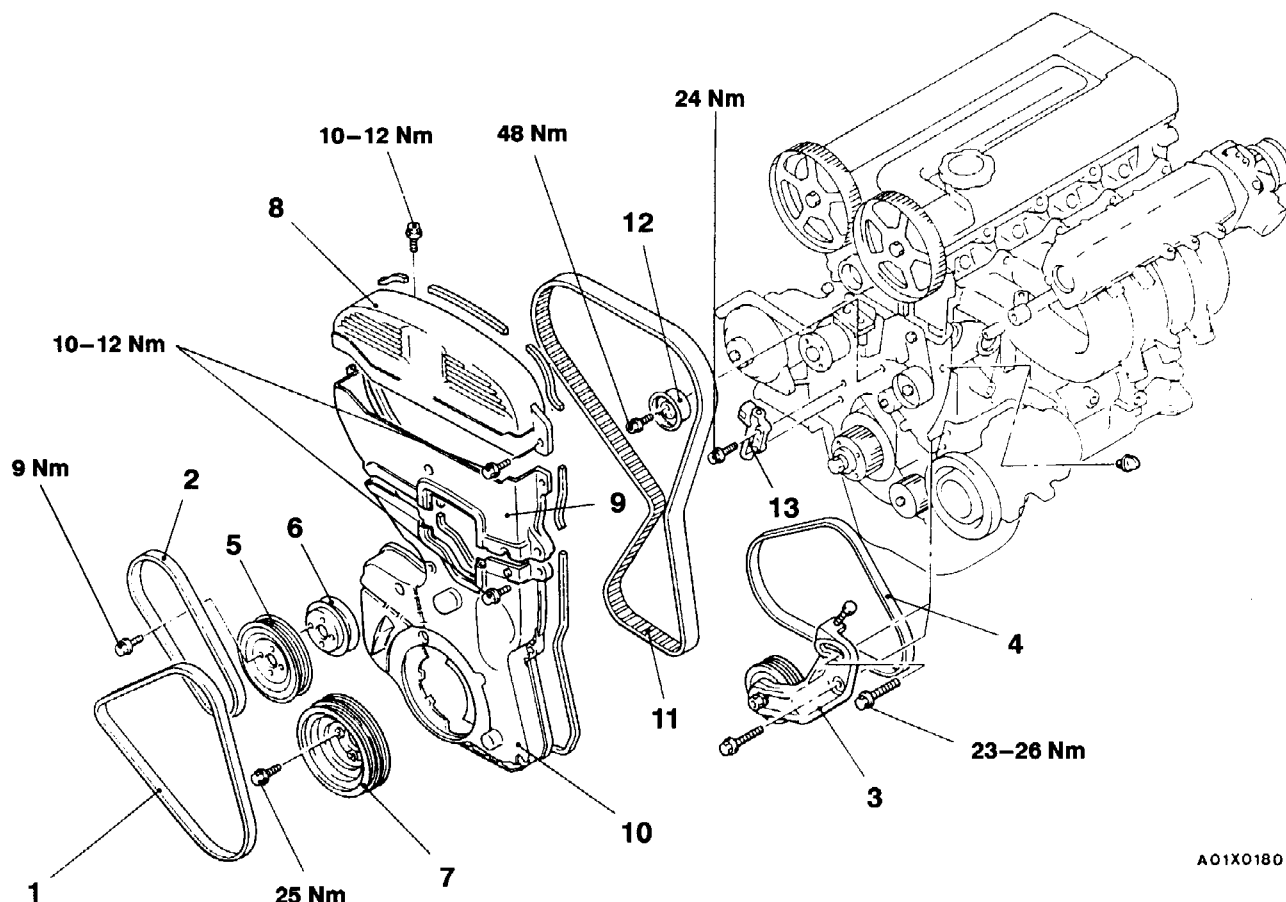
REMOVAL AND INSTALLATION

Pre-removal Operation

- (1) Under Cover Removal
- (2) Engine Mount Bracket Removal
(Refer to GROUP 32.)

Post-installation Operation

- (1) Under Cover Installation
- (2) Engine Adjustment (Refer to P.11A-8.)
- (3) Engine Mount Bracket Installation
(Refer to GROUP 32.)



A01X0180

Removal steps

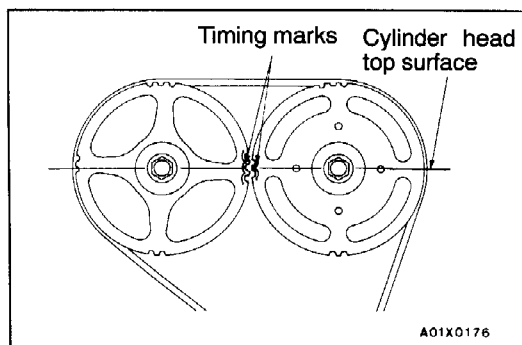
- Drive Belt Tension Adjustment
(Refer to P.11A-6.)

1. Drive belt (Alternator)
2. Drive belt (Power steering)
3. Tensioner pulley bracket
4. Drive belt (A/C)
5. Water pump pulley
6. Water pump pulley (Power steering)

- | | |
|-----|-----------------------------------|
| ▶D◀ | 7. Crankshaft pulley |
| ▶D◀ | 8. Timing belt front upper cover |
| ▶D◀ | 9. Timing belt front center cover |
| ▶C◀ | 10. Timing belt front lower cover |
| ▶B◀ | • Timing belt tension adjustment |
| ▶B◀ | 11. Timing belt |
| ▶A◀ | 12. Tension pulley |
| ▶A◀ | 13. Auto tensioner |

REMOVAL SERVICE POINTS**◀A▶ TIMING BELT FRONT CENTER COVER**

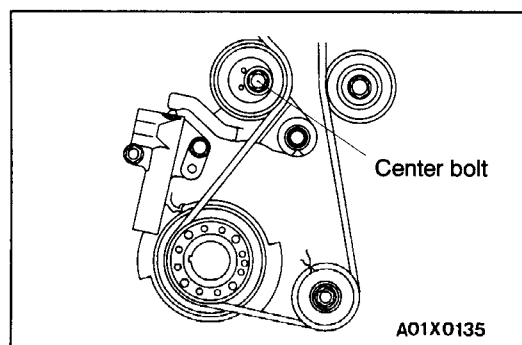
Remove the stud bolt of the engine support bracket, and remove the timing belt front center cover.

**◀B▶ TIMING BELT REMOVAL**

- (1) Turn the crankshaft clockwise (in the forward direction) to align the camshaft sprocket timing marks.

Caution

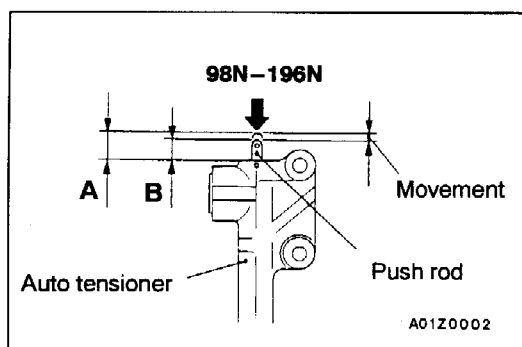
Always turn the crankshaft in the forward direction only.



- (2) Loosen the tension pulley center 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.

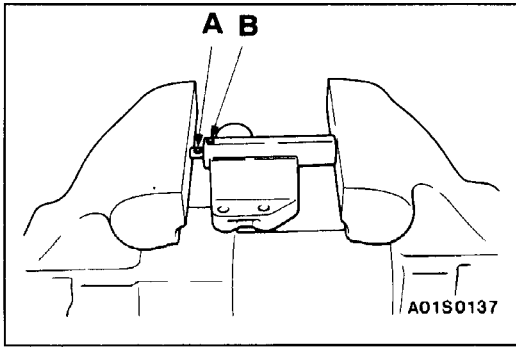
Standard value: Within 1 mm

A: Length when it is free (not pressed)

B: Length when it is pressed

A-B: Movement

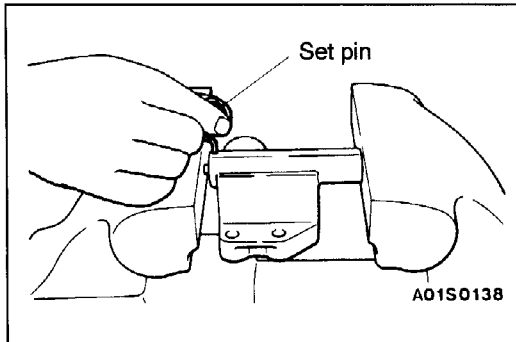
- (2) If it is out of the standard value, replace the auto tensioner.



- (3) Use a press or vise 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

Compress the rod slowly, or it may be damaged.

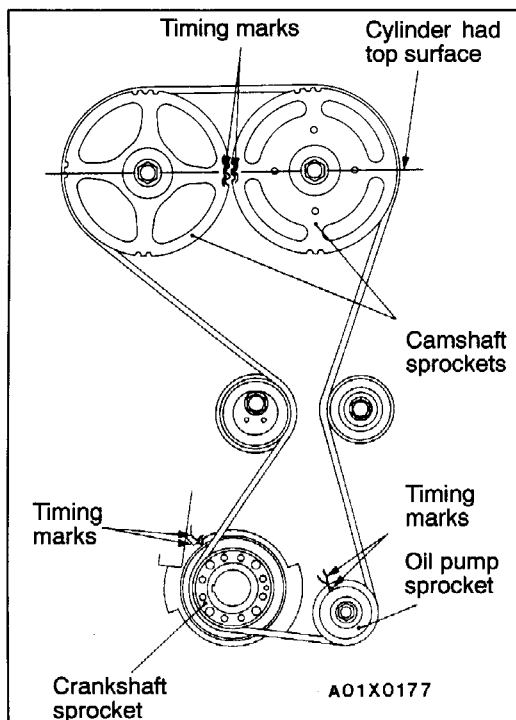


- (4) Once the holes are aligned, insert the set pin.

NOTE

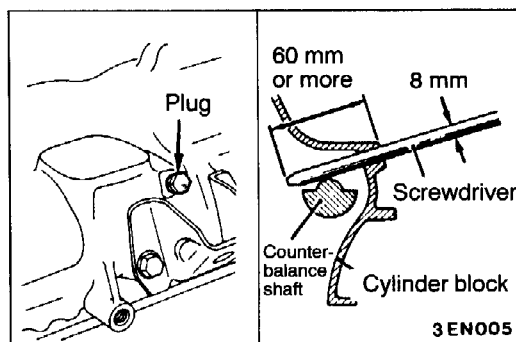
When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.

- (5) Install the auto tensioner to the engine.



▶B◀ TIMING BELT INSTALLATION

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



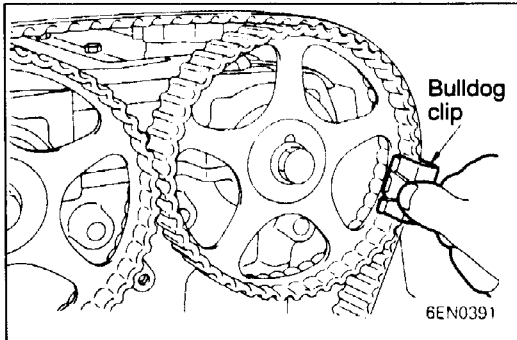
- (2) After aligning the timing mark on the oil pump sprocket, remove the cylinder block plug and insert a Phillips screwdriver with a diameter of 8 mm, and check to be sure that the screwdriver goes in 60 mm or more. If the screwdriver will only go in 20 – 25 mm before striking the counter-balance shaft, turn the sprocket once, realign the timing mark and check that the screwdriver goes in 60 mm or more.

Do not take out the screwdriver until the timing belt is installed.

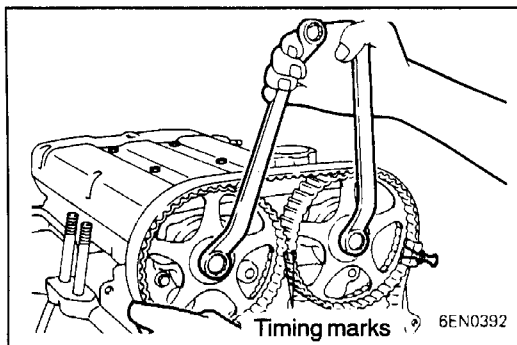
- (3) Install the timing belt so as not to be loosened among the sprockets, by the following procedure.

Caution

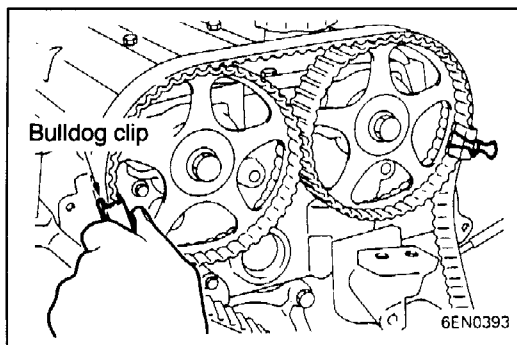
If the timing belt is to be reused, install it so that the mark indicates the clockwise direction.



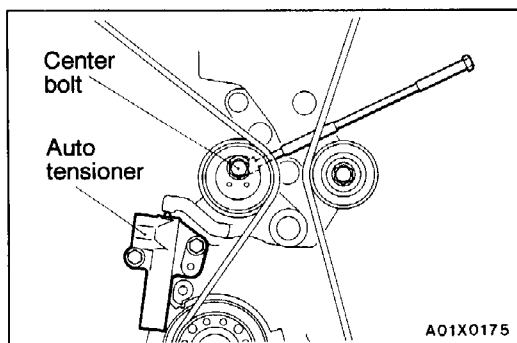
- 1) Install the timing belt around the intake side camshaft sprocket and fix it at indicated position by a bulldog clip.



- 2) Install the timing belt around the exhaust side sprocket, aligning the timing marks with the cylinder head top surface using two wrenches.

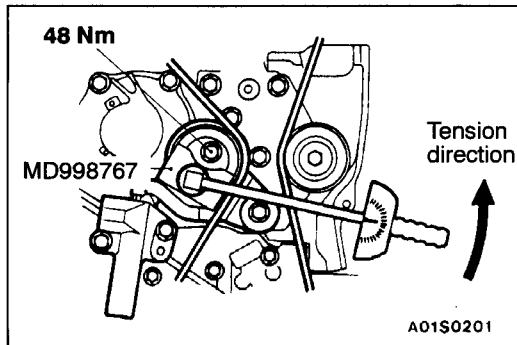


- 3) Fix the belt at indicated position by another binder clip.
 4) Install the timing belt around the idler pulley, the oil pump sprocket, the crankshaft sprocket and the tensioner pulley in the order shown.
 5) Remove the two bulldog clips.
 (4) Set the tension pulley so that the pin holes are at the bottom, press the tension pulley lightly against the timing belt.



- (5) Screw the tool into the engine left support bracket until its end makes contact with the tensioner arm. At that point, screw the tool in some more and then remove the set wire attached to the auto tensioner.
 (6) Remove the tool.
 (7) Tighten the center bolt to the specified torque.

Tightening torque: 48 Nm



►C◄ TIMING BELT TENSION ADJUSTMENT

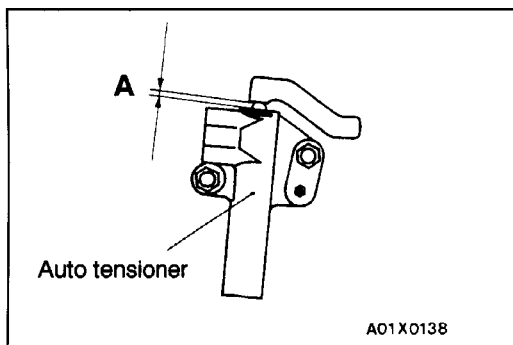
- (1) After turning the crankshaft 1/4 of a revolution anticlockwise, turn it clockwise until the timing marks are aligned.
- (2) Loosen the tension pulley fixing bolt, and then use the special tool and a torque wrench to tighten the fixing bolt to the specified torque while applying tension to the timing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

Standard value: 3.5 Nm

<Timing belt tension torque>

Caution

When tightening the fixing bolt, do not let the tension pulley turn with the bolt.



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

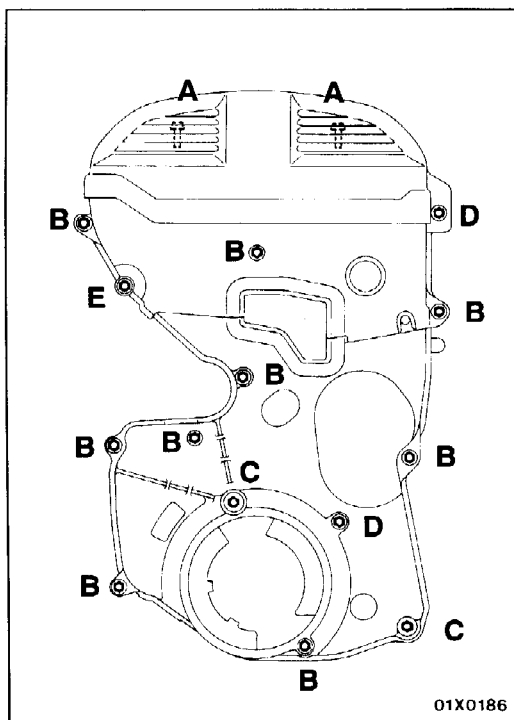
Standard value (A): 3.8–4.5 mm

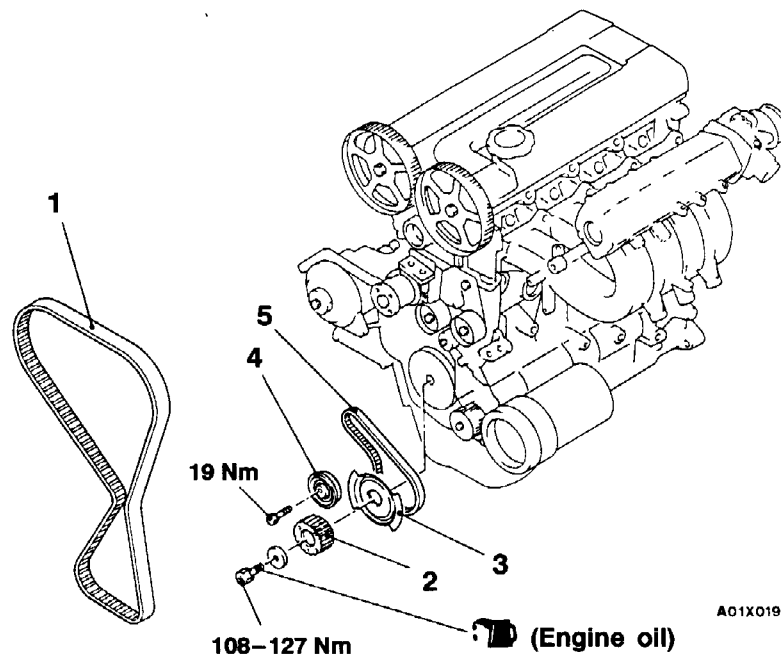
- (4) If the amount of protrusion is outside the standard value, repeat the operation in steps (1) to (3).
- (5) Check again that the timing marks of each sprocket are aligned.

►D◄ TIMING BELT FRONT LOWER COVER/ TIMING BELT FRONT CENTER COVER/ TIMING BELT FRONT UPPER COVER INSTALLATION

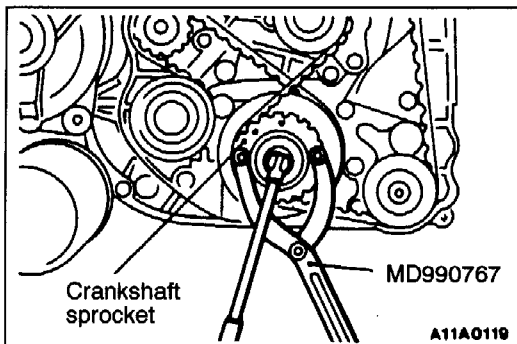
Install the bolts, being careful not to mistake the bolt sizes.

Thread diameter × thread length mm		Bolt classification	Tightening torque Nm
A	6 × 16	Flange bolt	10–12
B	6 × 18	Flange bolt	10–12
C	6 × 25	Washer assembled bolt	8–10
D	6 × 25	Flange bolt	10–12
E	6 × 45	Flange bolt	10–12

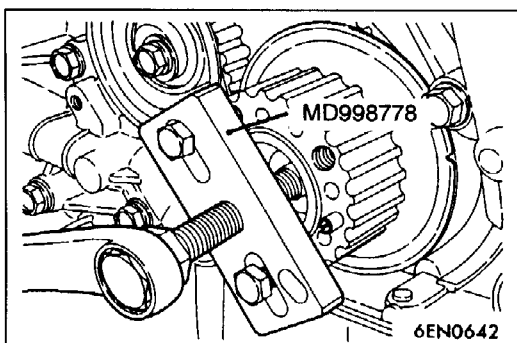


TIMING BELT B**REMOVAL AND INSTALLATION****Removal steps**

- ◀A▶ ▶D▶ 1. Timing belt (Refer to P.11A-29.)
- ▶C▶ 2. Crankshaft sprocket
- ▶B▶ 3. Crankshaft sensing blade
- Timing belt B tension adjustment
4. Timing belt B tensioner
- ▶B▶ ▶A▶ 5. Timing belt B

**REMOVAL SERVICE POINTS****◀A▶ CRANKSHAFT SPROCKET REMOVAL**

(1) Use the special tool to remove the bolt.

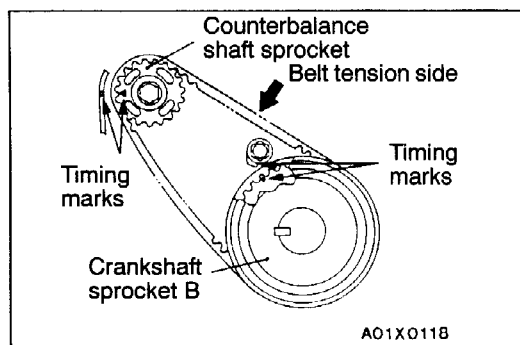


(2) Use the special tool to remove the crankshaft sprocket.

◀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).

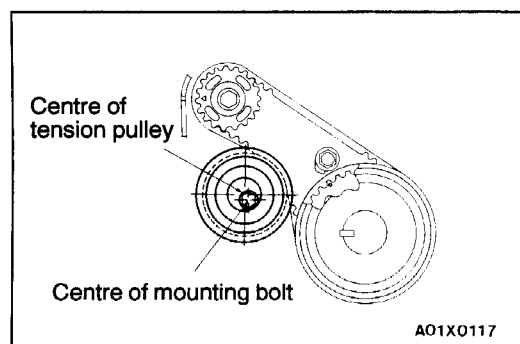


INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT B INSTALLATION

Install timing belt “B” by the following procedure.

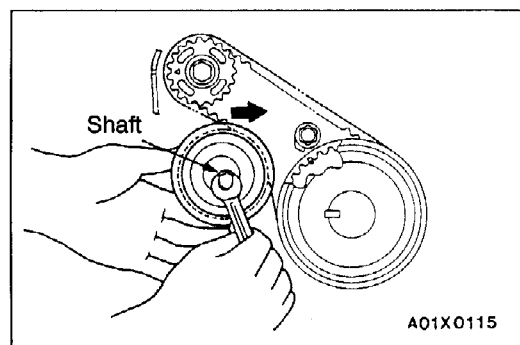
- (1) Ensure that crankshaft sprocket “B” timing mark and the counterbalance shaft sprocket timing mark are aligned.
- (2) Fit timing belt “B” over crankshaft sprocket “B” and the counterbalance shaft sprocket. Ensure that there is no slack in the belt.



▶B◀ TIMING BELT B TENSION ADJUSTMENT

Adjust the tension of timing belt “B” by the following procedure.

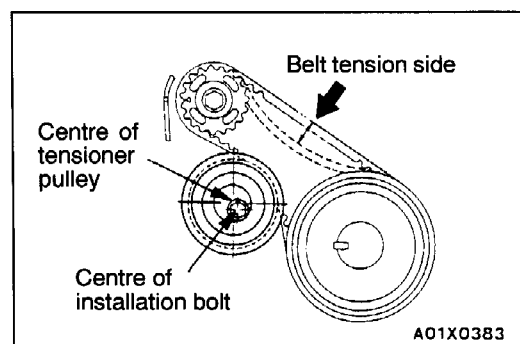
- (1) Temporarily fix the timing belt “B” tensioner such that the centre of the tensioner pulley is to the left and above the centre of the installation bolt, and temporarily attach the tensioner pulley so that the flange is towards the front of the engine.



- (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.

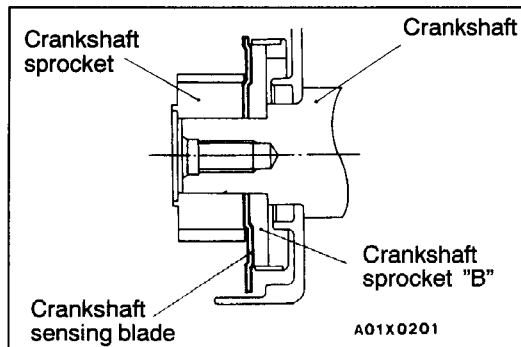
Caution

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.



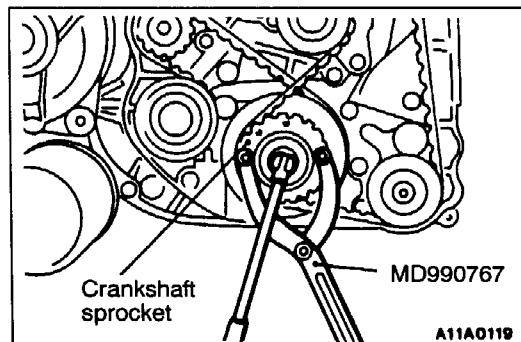
- (3) Press the belt at the shown point by a finger to check belt tension. If not, adjust.

Standard value: 5–7 mm



►C◄ CRANKSHAFT SENSING BLADE INSTALLATION

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



►D◄ CRANKSHAFT SPROCKET INSTALLATION

Use the special tool to install the crankshaft sprocket and bolt.

NOTE

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

ENGINE ASSEMBLY

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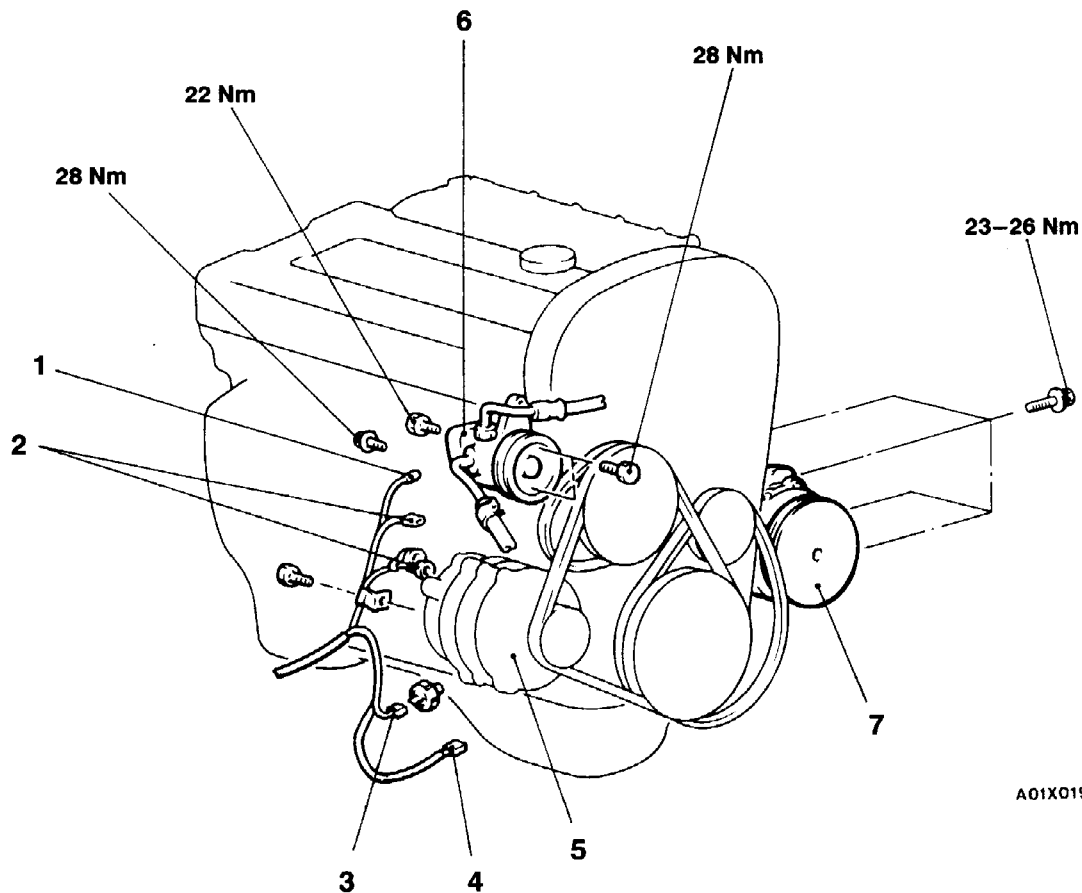
REMOVAL AND INSTALLATION

Pre-removal Operation

- (1) Fuel Line Pressure Releasing
(Refer to GROUP 13A – On-vehicle Service.)
- (2) Hood Removal
- (3) Engine Coolant Draining
(Refer to GROUP 14 – On-vehicle Service.)
- (4) Transmission Assembly Removal
(Refer to GROUP 22.)
- (5) Radiator Removal (Refer to GROUP 14.)
- (6) Under Cover Removal

Post-installation Operation

- (1) Radiator Installation (Refer to GROUP 14.)
- (2) Transmission Assembly Installation
(Refer to GROUP 22.)
- (3) Engine Coolant Supplying
(Refer to GROUP 14 – On-vehicle Service.)
- (4) Hood Installation
- (5) Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)
- (6) Under Cover Installation
- (7) Drive Belt Tension Adjustment (Refer to P.11A-6.)

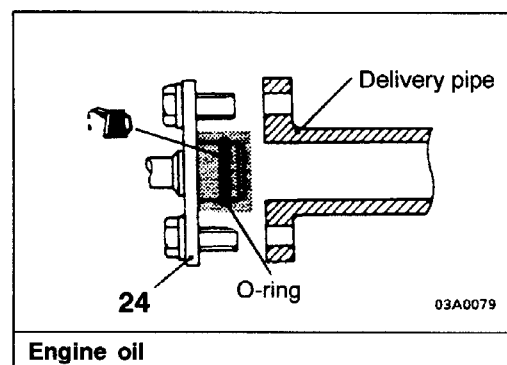
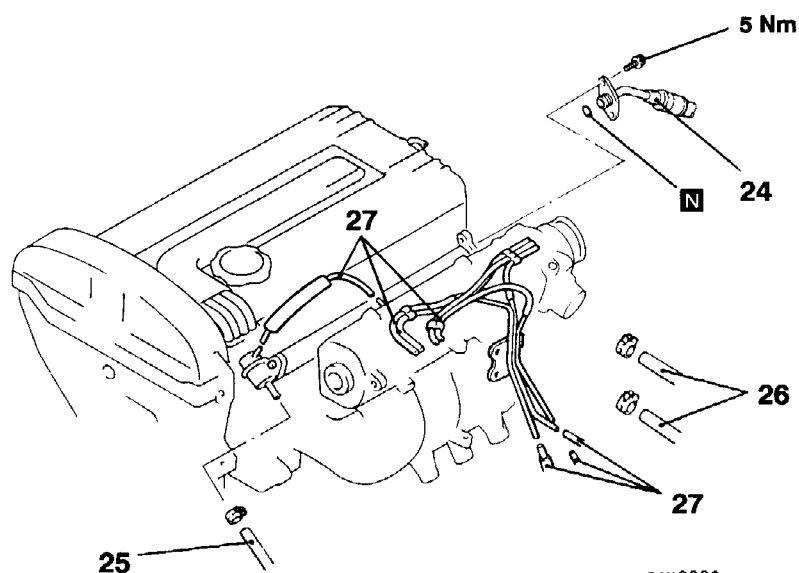
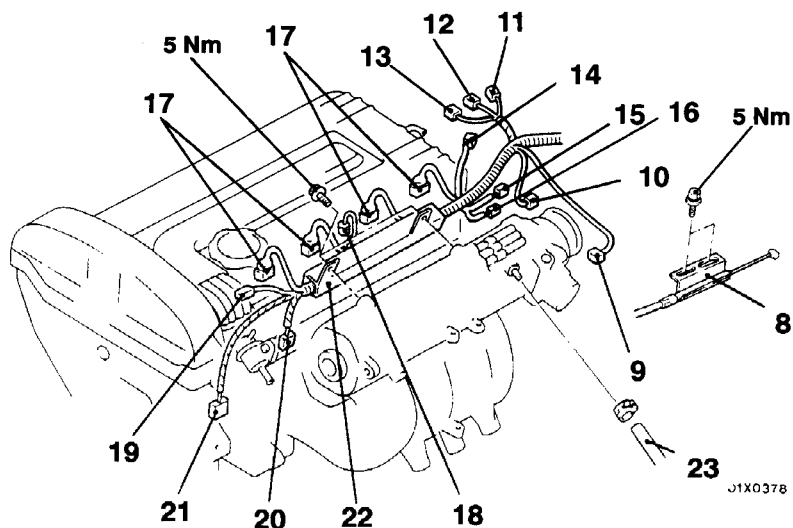


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Removal steps

1. Power steering oil pressure switch connector
2. Alternator connectors
3. Oil pressure switch connector
4. Oil pressure gauge unit connector
5. Alternator (Refer to GROUP 16.)
6. Power steering oil pump connection
7. A/C compressor connection

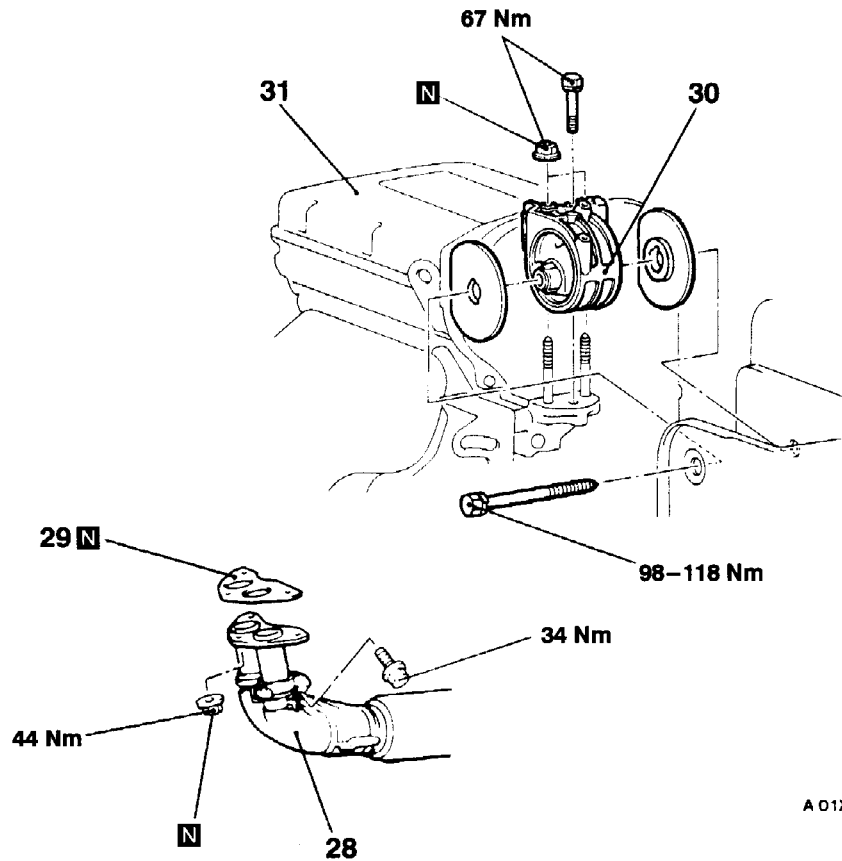




Engine oil

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- | | |
|---|--|
| 8. Accelerator cable connection | 18. Ignition coil connector |
| 9. ISC connector | 19. Camshaft position sensor connector |
| 10. Detonation sensor connector | 20. Crankshaft position sensor connector |
| 11. Oxygen sensor connector | 21. A/C compressor connector |
| 12. Engine coolant temperature gauge unit connector | 22. Control wiring harness |
| 13. Engine coolant temperature sensor connector | 23. Brake booster vacuum hose connection |
| 14. Power transistor connector | ►C◄ 24. High-pressure fuel hose connection |
| 15. Throttle position sensor connector | 25. Fuel return hose connection |
| 16. Capacitor connector | 26. Heater hose connection |
| 17. Injector connectors | 27. Vacuum hose connection |



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28. Front exhaust pipe connection
 29. Gasket
 30. Engine mount bracket
 31. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP REMOVAL

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

NOTE

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

◀B▶ A/C COMPRESSOR REMOVAL

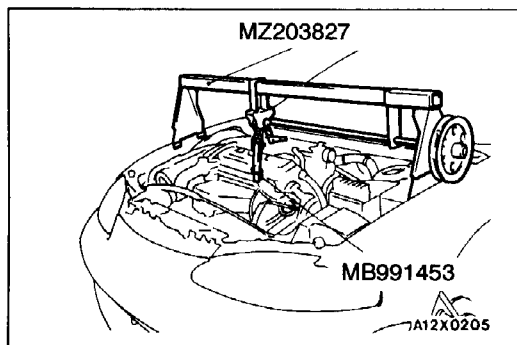
Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE

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

Caution

Do not bend the joint between the A/C hose and the A/C pipe by force.

**◀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, lift the chain block slowly to remove the engine assembly upwards from the engine compartment.

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

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

►B◄ ENGINE MOUNT BRACKET INSTALLATION

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

►C◄ HIGH-PRESSURE FUEL HOSE CONNECTION

When connecting the high-pressure fuel hose to the delivery pipe, apply a small amount of clean engine oil to the hose union and then insert, being careful not to damage the O-ring.

Caution

Do not let engine oil get into the delivery pipe.

NOTES