

ENGINE

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11109000276

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ENGINE <4G1>

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GENERAL INFORMATION

11100010186

Items		4G13	
Total displacement ml		1,299	
Bore × Stroke mm		71 × 82	
Compression ratio		9.5	
Combustion chamber		Semi spherical type	
Camshaft arrangement		SOHC	
Number of valve	Intake	8	
	Exhaust	4	
Valve timing	Intake	Opening	BTDC 19°
		Closing	ABDC 43°
	Exhaust	Opening	BBDC 60°
		Closing	ATDC 8°
Fuel system		Electronically controlled multipoint fuel injection	
Rocker arm		Roller type	
Auto-lash adjuster		Not equipped	

SERVICE SPECIFICATIONS

11100030236

Items		Standard value	Limit
Alternator drive belt tension	Tension N	When checked	392 – 588
		When a used belt is installed	441 – 539
		When a new belt is installed	637 – 833
	Deflection (Reference value) mm	When checked	8.7 – 11.4
		When a used belt is installed	9.2 – 10.6
		When a new belt is installed	6.6 – 8.3
Power steering oil pump and A/C compressor drive belt tension	Tension N	When checked	392 – 588
		When a used belt is installed	441 – 539
		When a new belt is installed	637 – 833
	Deflection (Reference value) mm	When checked	9.6 – 12.4
		When a used belt is installed	10.2 – 11.6
		When a new belt is installed	7.2 – 9.0
Valve clearance (at hot) mm		Intake valve	0.20
		Exhaust valve	0.25

Items	Standard value	Limit
Basic ignition timing	5° BTDC±2°	–
Idle speed r/min	750±100	–
CO contents %	0.5 or less	–
HC contents ppm	100 or less	–
Compression pressure (250–400 r/min) kPa	1226	min. 863
Compression pressure difference of all cylinder kPa	–	max. 100
Intake manifold vacuum kPa	min. 60	–
Cylinder head bolt shank length mm	–	103.2

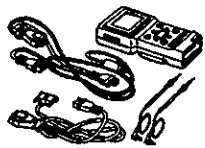
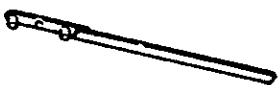
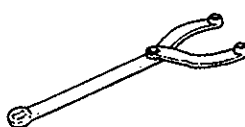
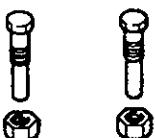
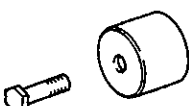
SEALANT

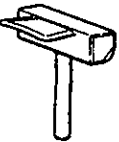
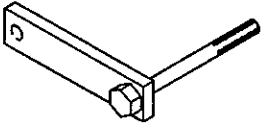
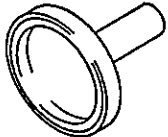
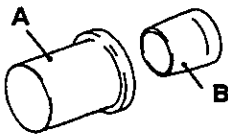
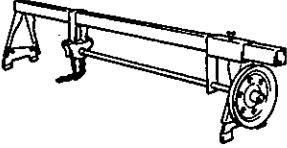
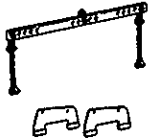
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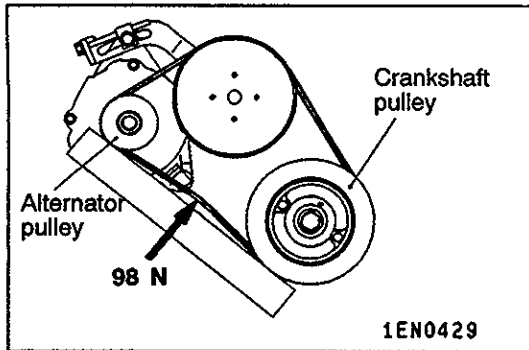
Item	Specified sealant	Remark
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

11100060228

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Checking the idle speed
	MD998747	Crankshaft pulley holder	Holding the crankshaft pulley
	MB990767	End yoke holder	Holding the camshaft sprocket
	MD998719 or MD998754	Crankshaft pulley holder pin	
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal

Tool	Number	Name	Use
	MD998727	Oil pan remover	Removal of oil pan
	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>
	MD998718	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	A: MD998304 B: MD998305	A: Crankshaft front oil seal installer B: Crankshaft front oil seal guide	Press-in of the crankshaft front oil seal
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991453	Engine hanger assembly	



ON-VEHICLE SERVICE

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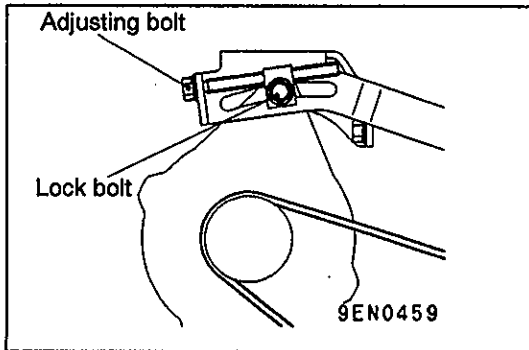
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Use a belt tension gauge to check that the belt tension is at the standard value at a point half-way between the two pulleys as shown in the illustration. In addition, press this section with a force of 98 N and check that the amount of belt deflection is at the standard value.

Standard value:

Tension N	392 – 588
Deflection (Reference value) mm	8.7 – 11.4



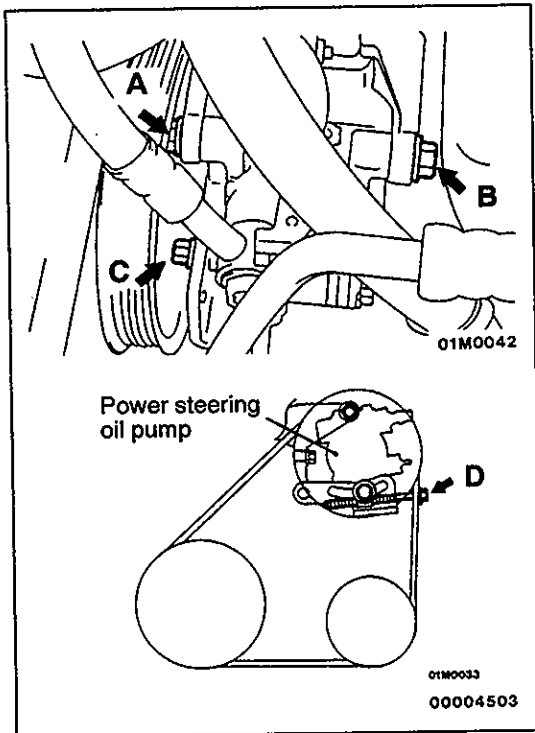
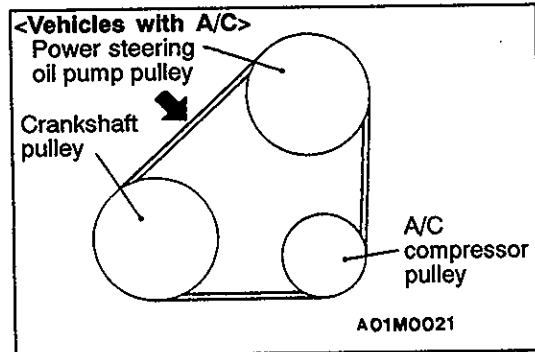
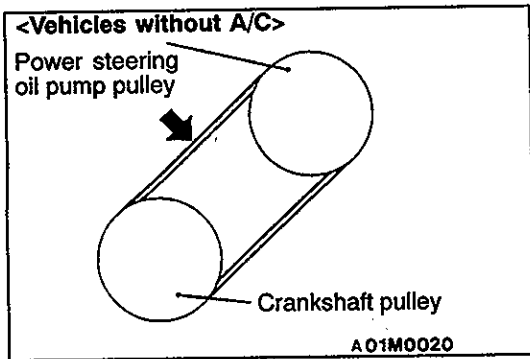
ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

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

Standard value:

Items	When a used belt is installed	When a new belt is installed
Tension N	441 – 539	637 – 833
Deflection (Reference value) mm	9.2 – 10.6	6.6 – 8.3

4. Tighten the lock bolt.
Tightening torque: 23 Nm
5. Tighten the nut of the alternator pivot bolt.
Tightening torque: 44 Nm
6. Tighten the adjusting bolt.
Tightening torque: 9.8 Nm



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

11100130066

1. Use a belt tension gauge to check that the belt tension is at the standard value at a point half-way between the two pulleys (indicated by an arrow in the illustration). In addition, press this section with a force of 98 N and check that the amount of belt deflection is at the standard value.

Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Tension N	392 – 588	441 – 539	637 – 833
Deflection (Reference value) mm	9.6 – 12.4	10.2 – 11.6	7.2 – 9.0

2. If the tension or deflection is outside the standard value, adjust by the following procedure.

- (1) Loosen power steering oil pump fixing bolts A, B and C.
- (2) Adjust the amount of belt deflection using adjusting bolt D.
- (3) Tighten fixing bolts A, B and C.

Tightening torque:

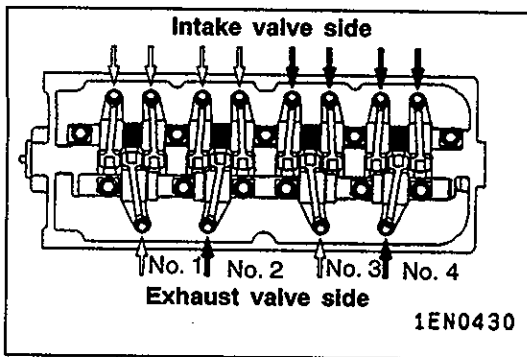
Bolts A and B: 39 Nm

Bolt C: 49 Nm

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

Caution

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



VALVE CLEARANCE CHECK AND ADJUSTMENT

11100150055

1. Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 95°C.
2. Remove all spark plugs from the cylinder head for easy inspection.
3. Remove the rocker cover.
4. Turn the crankshaft clockwise until the notch on the pulley is lined up with the "T" mark on the timing indicator.
5. Move the rocker arms on the No. 1 and No. 4 cylinders up and down by hand to determine which cylinder has its piston at the top dead centre on the compression stroke. If both intake and exhaust valve rocker arms have a valve lash, the piston in the cylinder corresponding to these rocker arms is at the top dead centre on the compression stroke.
6. Valve clearance inspection and adjustment can be performed on rocker arms indicated by white arrow mark when the No. 1 cylinder piston is at the top dead centre on the compression stroke, and on rocker arms indicated by black arrow mark when the No. 4 cylinder piston is at the top dead centre on the compression stroke.

7. Measure the valve clearance.
If the valve clearance is not as specified, loosen the rocker arm lock nut and adjust the clearance using a thickness gauge while turning the adjusting screw.

Standard value (hot engine):

Intake valve: 0.20 mm

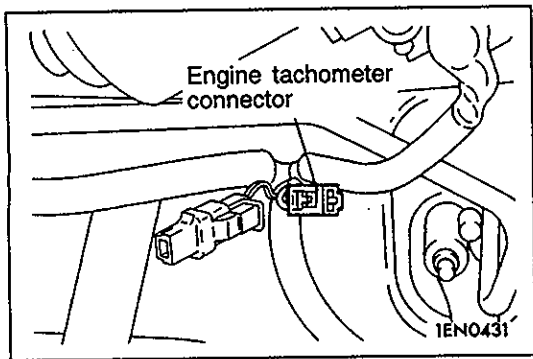
Exhaust valve: 0.25 mm

8. While holding the adjusting screw with a screwdriver to prevent it from turning, tighten the lock nut to the specified torque.

Tightening torque: 15 Nm

9. Turn the crankshaft through 360° to line up the notch on the crankshaft pulley with the "T" mark on the timing indicator.
10. Repeat steps (7) and (8) on other valves for clearance adjustment.
11. Install the rocker cover.
12. Install the spark plugs and tighten to the specified torque.

Tightening torque: 25 Nm



IGNITION TIMING CHECK AND ADJUSTMENT

11100160126

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 as shown.
3. Connect a primary voltage-detection type of tachometer to the paper clip.

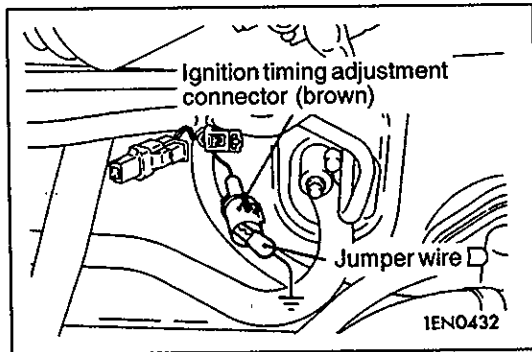
NOTE

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 it at idle.
6. Check that engine idle speed is within the standard value.

Standard value: 750±100 r/min



7. Turn the ignition switch to OFF.
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 earth this to the body as illustrated.

NOTE

Earthing 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.

Standard value: 5° BTDC±2°

12. If not within the standard value, loosen distributor mounting bolt and adjust by rotating distributor body.
13. Tighten mounting bolt after adjusting.

Tightening torque: 12 Nm

14. Stop the engine, remove the jumper wire from the ignition timing adjustment connector (brown), and return the connector to its original condition.
15. Start the engine and check that ignition timing at the standard value.

Standard value: Approx. 10° BTDC

NOTE

1. Ignition timing is variable within about ± 7°, even under normal operating.
2. And it is automatically further advanced by about 5° from 10° BTDC at higher altitudes.

16. Sealing tape is to be attached to the fitting nut only for vehicles for Switzerland.

NOTE

Sealing tape is attached to all vehicles when new.

IDLE SPEED CHECK

11100190200

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Check the basic ignition timing. Adjust if necessary.
Standard value: 5° BTDC \pm 2°
3. After turning the ignition switch to OFF, connect the MUT-II to the diagnosis connector.
4. Start the engine and run it at idle.
5. Run the engine at idle for 2 minutes.
6. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

Curb idle speed: 750 \pm 100 r/min

NOTE

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

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

IDLE MIXTURE CHECK

11100210173

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° BTDC \pm 2°
3. Turn the ignition switch to OFF and connect the MUT-II to the diagnosis connector.
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 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.)

- Combustion pressure
- Injector
- Ignition coil, spark plug cable, spark plug
- Leak in the EGR system and in the EGR valve
- Evaporative emission control system
- Compression pressure

NOTE

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

COMPRESSION PRESSURE CHECK

11100260208

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 distributor 7-pin connector.

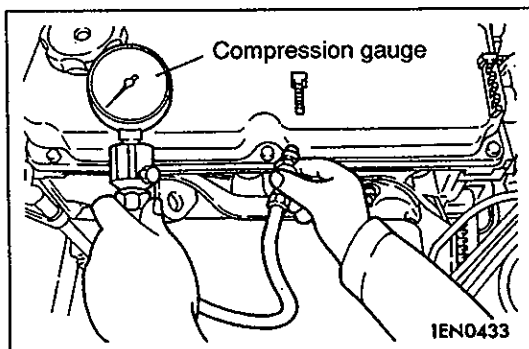
NOTE

Doing this will prevent the engine-ECU 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):
1226 kPa

Limit (at engine speed of 250–400 r/min):
min. 863 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).

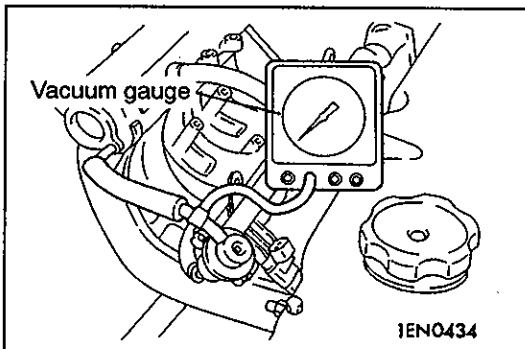
(1) if the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.

(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 distributor 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 distributor connector being disconnected.

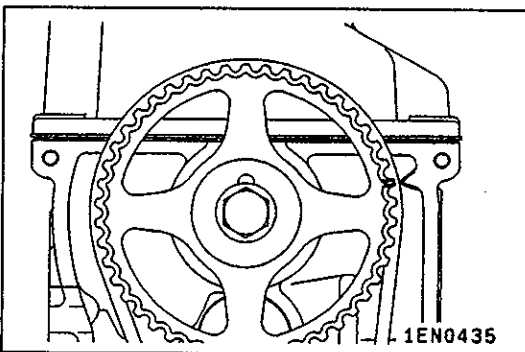


MANIFOLD VACUUM CHECK

11100270201

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



TIMING BELT TENSION ADJUSTMENT

11100280068

1. Remove the timing belt upper cover.
2. Turn the crankshaft clockwise to set the No. 1 cylinder to top dead compression centre.

Caution

As the purpose of this procedure is to apply the proper amount of tension to the timing belt by means of the cam drive torque, be sure not to rotate the crankshaft in the opposite direction.

3. Remove the access cover.
4. Loosen the timing belt tensioner fixing bolt to apply tension to the belt by means of the force of the tensioner spring.

Caution

The bolt can be loosened 90°–180°.

If the belt is loosened more than necessary, the bolt may fall in side the cover.

5. Tighten the timing belt tensioner fixing bolt.
6. Install the access cover.
7. Install the timing belt upper cover.

CRANKSHAFT PULLEY REMOVAL AND INSTALLATION

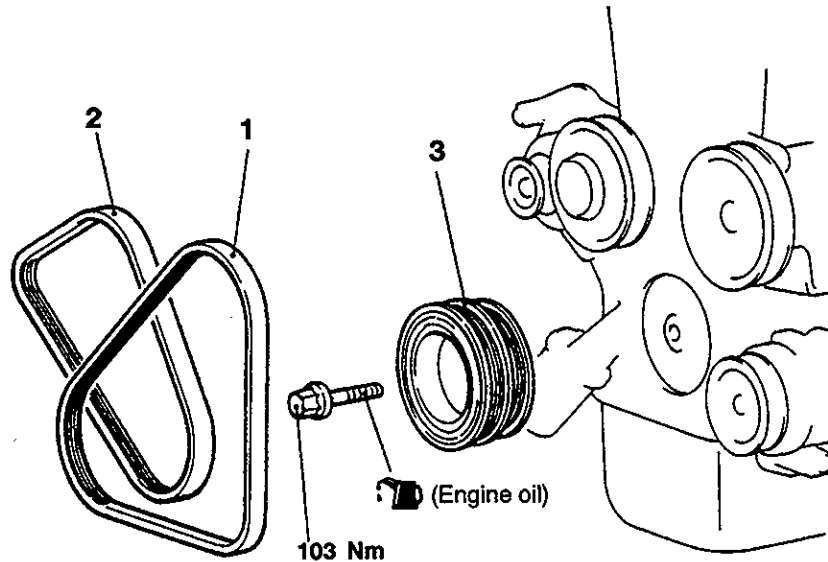
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Pre-removal Operation

- Under Cover Removal

Post-installation Operation

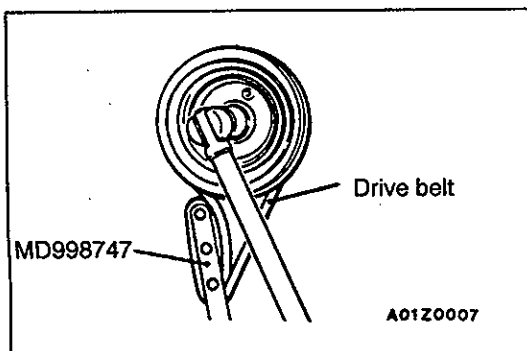
- Drive Belt Tension Adjustment (Refer to P.11A-6.)
- Under Cover Installation



A01M0022

Removal steps

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



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT PULLEY REMOVAL

Caution

1. This drive belt will get damaged. Do not use the engine's drive belt.
2. Never use a damaged drive belt.

INSTALLATION SERVICE POINT

▶A◀ CRANKSHAFT PULLEY INSTALLATION

When installing the crankshaft bolt, apply the minimum amount of engine oil to the bearing surface and thread of the bolt.

Caution

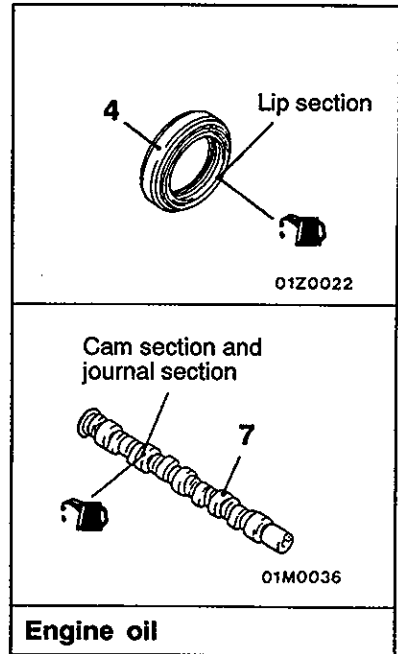
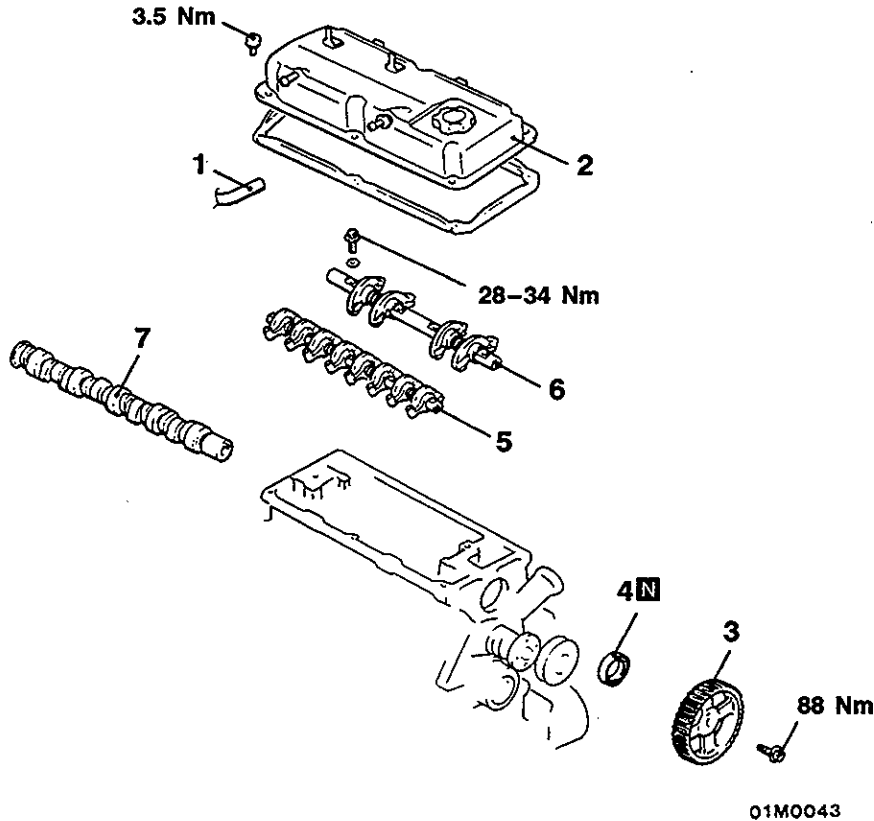
1. This drive belt will get damaged. Do not use the engine's drive belt.
2. Never use a damaged drive belt.

CAMSHAFT AND CAMSHAFT OIL SEAL

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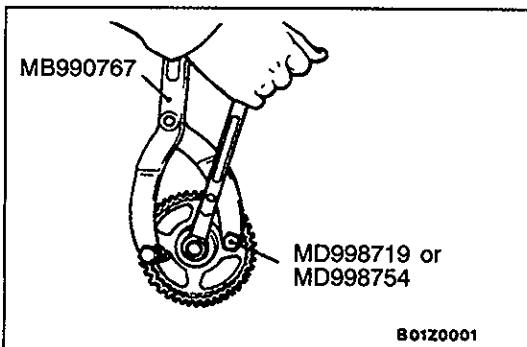
REMOVAL AND INSTALLATION

- Pre-removal and Post-installation Operation**
- Air Cleaner Removal and Installation
 - Distributor Removal and Installation (Refer to GROUP 16.)
 - Timing Belt Removal and Installation (Refer to P.11A-23.)



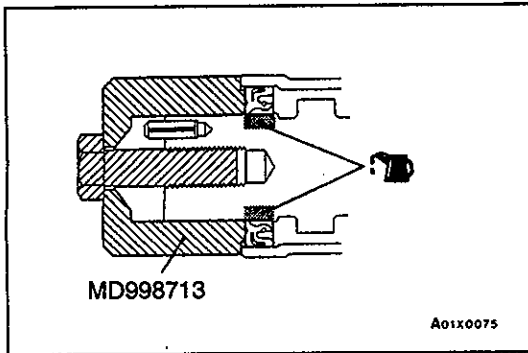
Removal steps

1. PCV hose connection
2. Rocker cover
 - Valve clearance adjustment (Refer to P.11A-8.)
3. Camshaft sprocket
4. Camshaft oil seal
5. Rocker arm and shaft assembly (intake side)
6. Rocker arm and shaft assembly (exhaust side)
7. Camshaft



REMOVAL SERVICE POINT

◀▶ **CAMSHAFT SPROCKET REMOVAL**

**INSTALLATION SERVICE POINTS****▶A◀ CAMSHAFT OIL SEAL INSTALLATION**

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

▶B◀ CAMSHAFT SPROCKET INSTALLATION

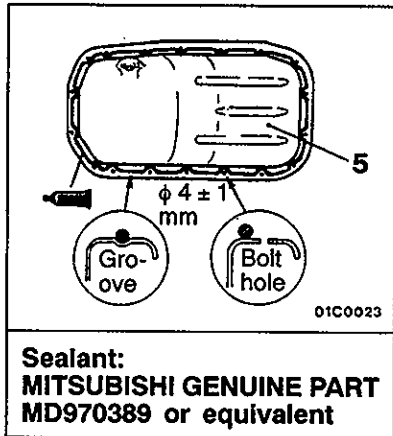
Use the special tool to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

OIL PAN

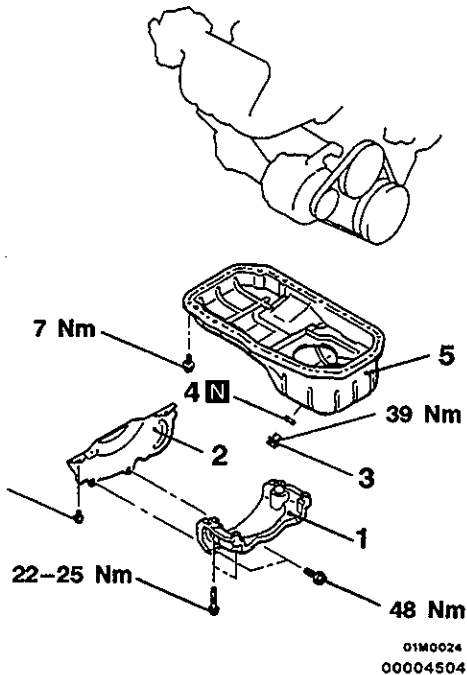
REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Oil Level Gauge Removal and Installation
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)



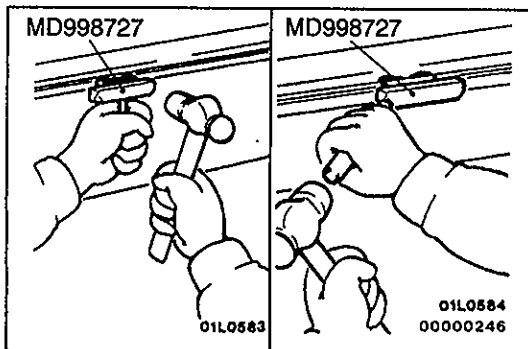
9 Nm <Bolt and washer assembled>
 10 Nm <Flange bolt>



Removal steps

1. Transmission stay
2. Bell housing cover
3. Drain plug

- ◀A▶ 4. Drain plug gasket
 ▶A▶ 5. Oil pan



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.

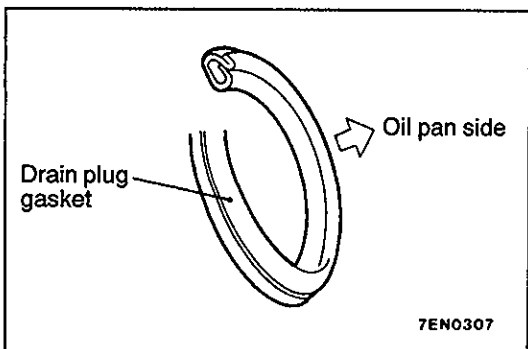
Caution

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

INSTALLATION SERVICE POINT

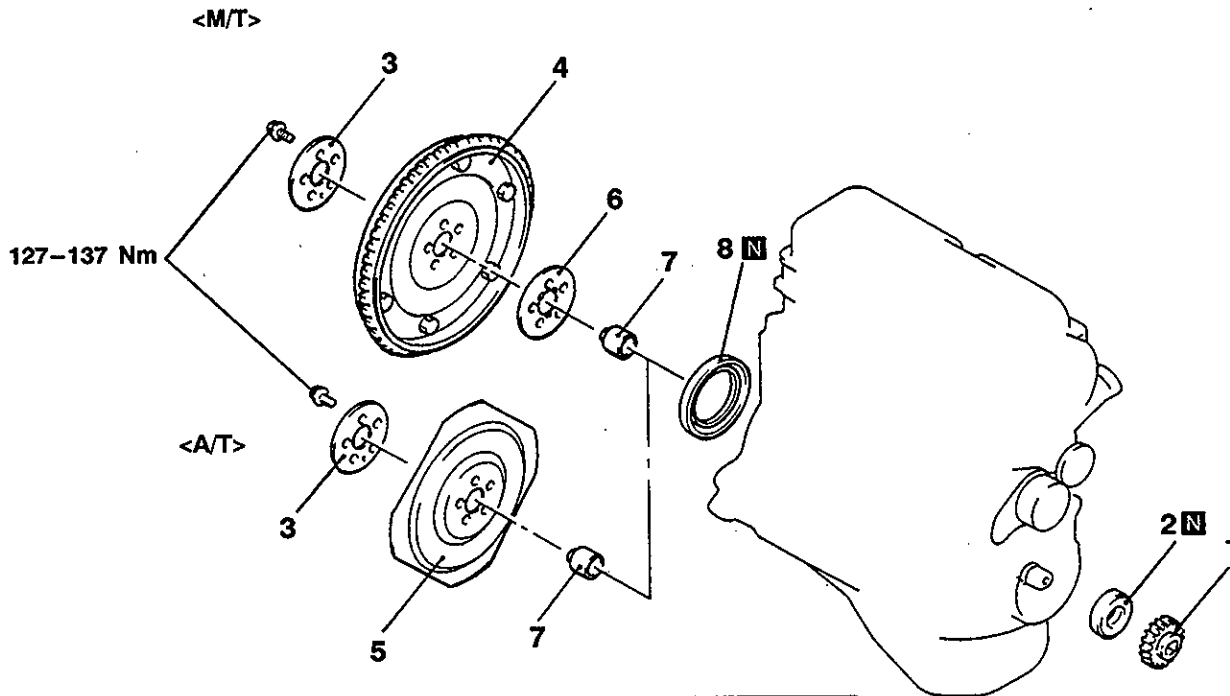
▶A◀ DRAIN PLUG GASKET INSTALLATION

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

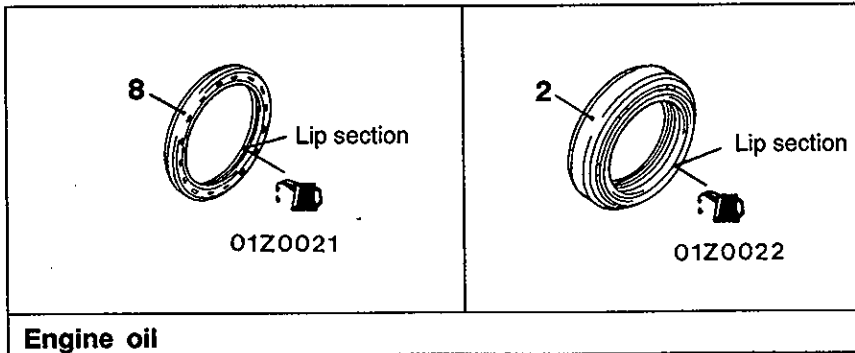


**CRANKSHAFT OIL SEAL
REMOVAL AND INSTALLATION**

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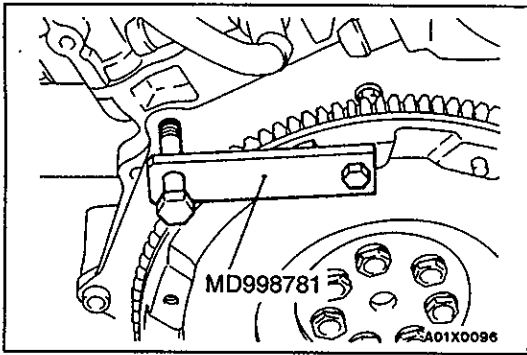


Crankshaft front oil seal removal steps

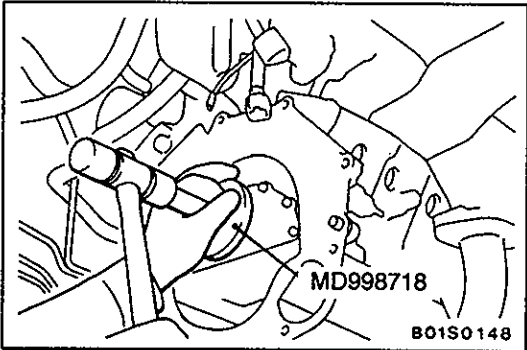
- Timing belt (Refer to P.11A-23.)
- ▶◀ 1. Crankshaft sprocket
- ▶◀ 2. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

- Transmission assembly (M/T: Refer to GROUP 22.) (A/T: Refer to GROUP 23.)
- Clutch cover and disc <M/T>
- ▶◀ 3. Adapter plate
- ▶◀ 4. Flywheel <M/T>
- ▶◀ 5. Drive plate <A/T>
- ▶◀ 6. Adapter plate <M/T>
- ▶◀ 7. Crankshaft bushing
- ▶◀ 8. Crankshaft rear oil seal

**REMOVAL SERVICE POINT****◀A▶ ADAPTER PLATE/FLYWHEEL <M/T>/DRIVE PLATE <A/T> REMOVAL**

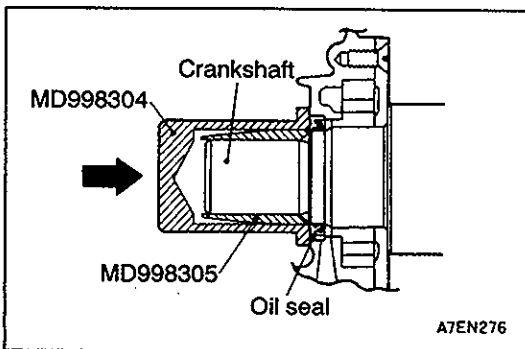
Use the special tool to secure the flywheel or drive plate, and remove the bolts.

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

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap in the oil seal as show in the illustration.

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

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

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

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

CYLINDER HEAD GASKET

11200400269

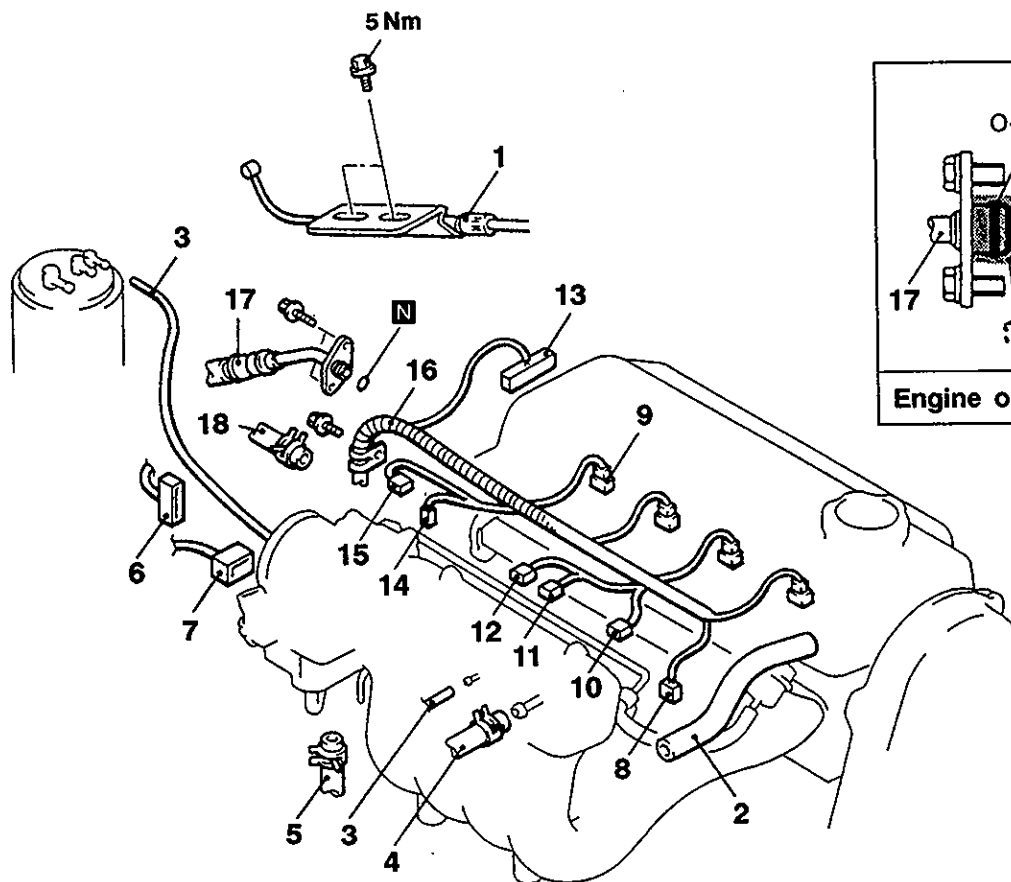
REMOVAL AND INSTALLATION

Pre-removal Operation

- Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.)
- Engine Oil Draining (Refer to GROUP 12 – On-vehicle Service.)
- Thermostat Case Assembly Removal (Refer to GROUP 14 – Water Hose and Water Pipe.)

Post-installation Operation

- Thermostat Case Assembly Installation (Refer to GROUP 14 – Water Hose and Water Pipe.)
- Engine Oil Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



01M0041

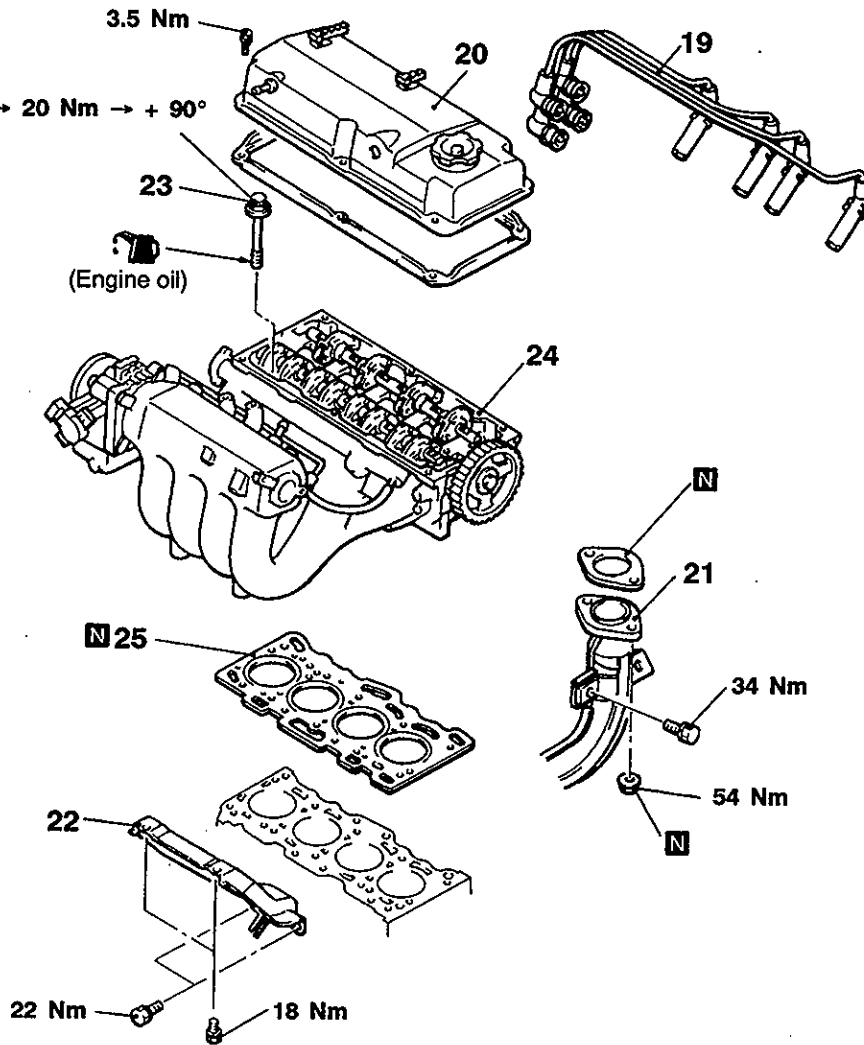
00004507

Removal steps

1. Accelerator cable connection
2. PCV hose
3. Vacuum hose connection
4. Brake booster vacuum hose connection
5. Water hose connection
6. Throttle position sensor connector
7. Idle speed control connector
8. Oxygen sensor connector
9. Injector connector
10. Intake air temperature sensor connector
11. Purge control solenoid valve connector
12. EGR solenoid valve connector
13. Distributor connector
14. Engine coolant temperature gauge unit connector
15. Engine coolant temperature sensor connector
16. Control wiring harness
17. High-pressure fuel hose connection
18. Fuel return hose connection



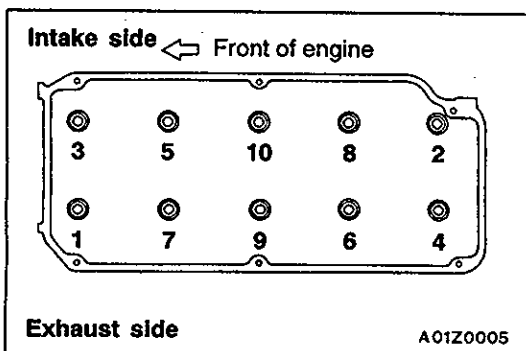
<Cold engine>
 49 Nm → 0 Nm → 20 Nm → + 90°
 → + 90°



A01M0036

- 19. Spark plug cables
- 20. Rocker cover
 - Timing belt (Refer to P.11A-23.)
- 21. Front exhaust pipe connection

- ◀A▶ ▶B▶ 22. Intake manifold stay
- ▶A▶ 23. Cylinder head bolts
- ▶A▶ 24. Cylinder head
- ▶A▶ 25. Cylinder head gasket



REMOVAL SERVICE POINT

◀A▶ CYLINDER HEAD BOLT REMOVAL

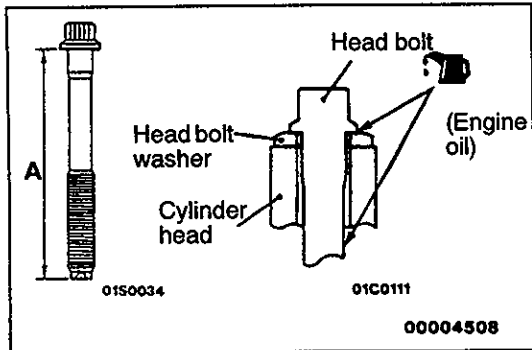
Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head assembly.

A01Z0005

INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

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



▶B◀ CYLINDER HEAD BOLT INSTALLATION

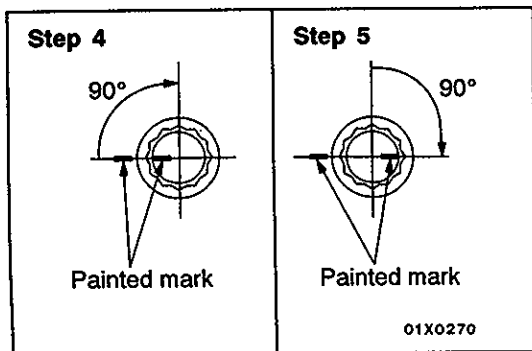
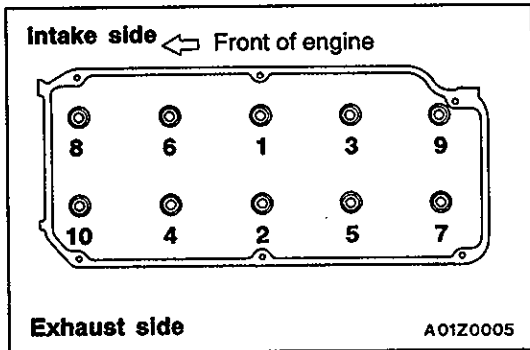
1. When installing the cylinder head bolts, the length below the head of the bolts should be within the limit. If it is outside the limit, replace the bolts.

Limit (A): 103.2 mm

2. The head bolt washer should be installed with the burred side caused by tapping out facing upwards.

3. Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 49 Nm.	Carry out in the order shown in the illustration.
2	Fully loosen.	Carry out in the reverse order of that shown in the illustration.
3	Tighten to 20 Nm.	Carry out in the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
5	Tighten 90° of a turn.	In the order shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.



Caution

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

▶C◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

Caution

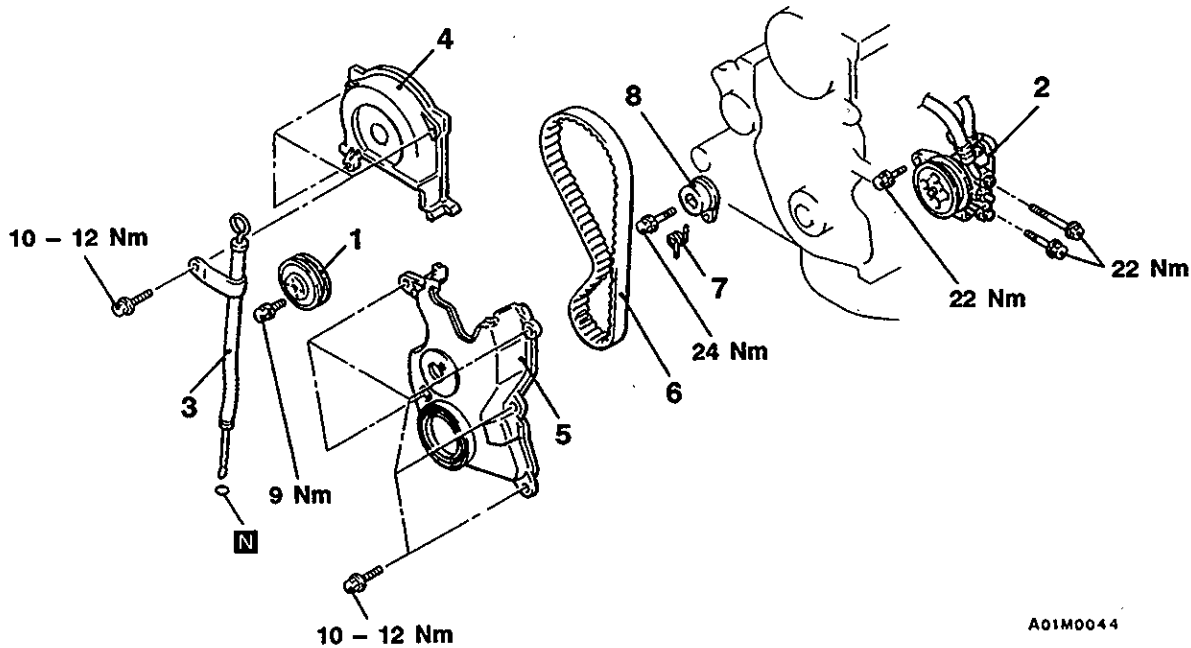
Do not let any engine oil get into the delivery pipe.

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

TIMING BELT

REMOVAL AND INSTALLATION

- Pre-removal and Post-installation Operation**
- Crankshaft Pulley Removal and Installation (Refer to P.11A-13.)
 - Engine Mount Bracket Removal and Installation (Refer to GROUP 32 – Engine Mounting.)



Removal steps



1. Water pump pulley
2. Power steering oil pump and bracket assembly
3. Oil level gauge guide assembly
4. Timing belt upper cover



5. Timing belt lower cover
- Timing belt tension adjustment
6. Timing belt
7. Tensioner spring
8. Timing belt tensioner

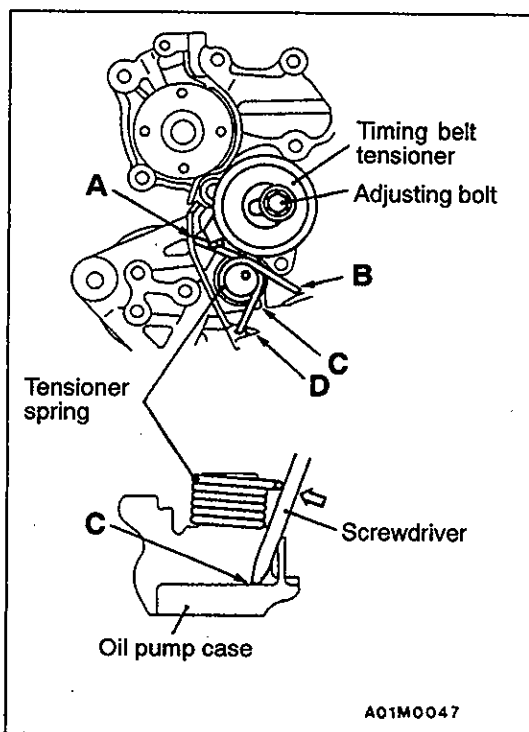
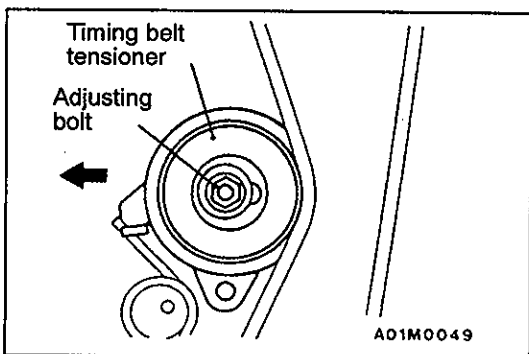
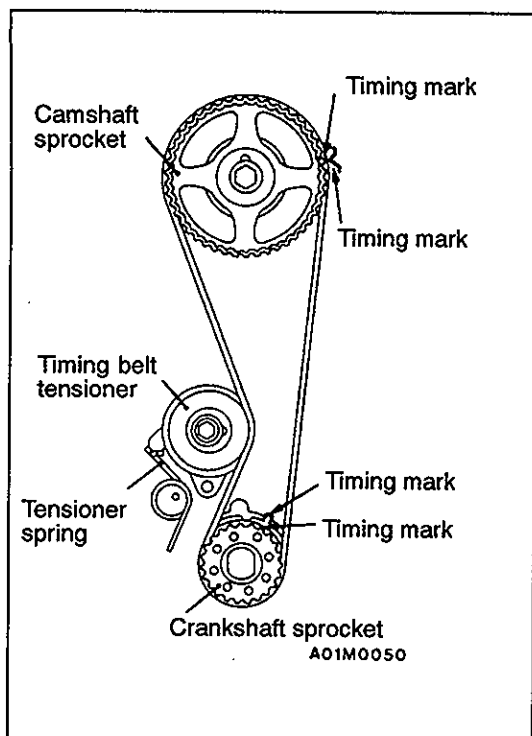
REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

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

NOTE

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



◀B▶ TIMING BELT REMOVAL

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

Caution

The crankshaft should always be turned only clockwise.

2. Loosen the adjusting bolt.
3. Move the timing belt tensioner to the water pump side and temporarily tighten the adjusting bolt so that the tensioner does not return.
4. Remove the timing belt.

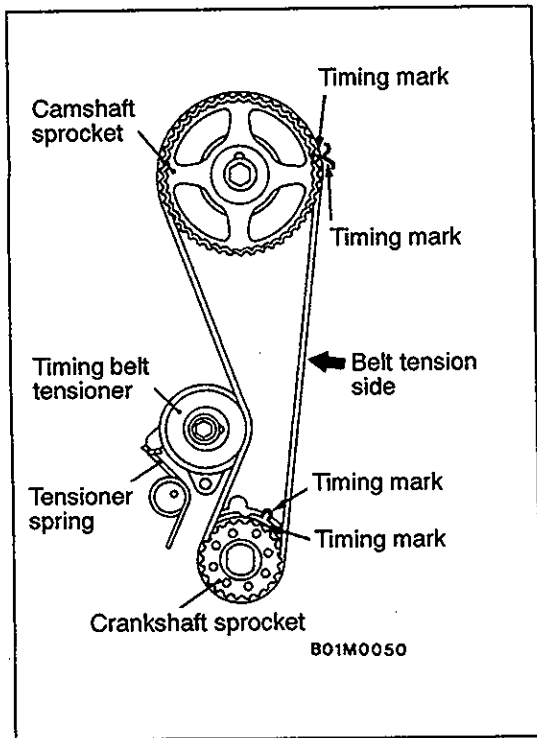
Caution

If the timing belt is to be re-used, use chalk to mark the flat side of the belt with an arrow indicating the direction of rotation (right turn).

INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT TENSIONER/TENSIONER SPRING/TIMING BELT INSTALLATION

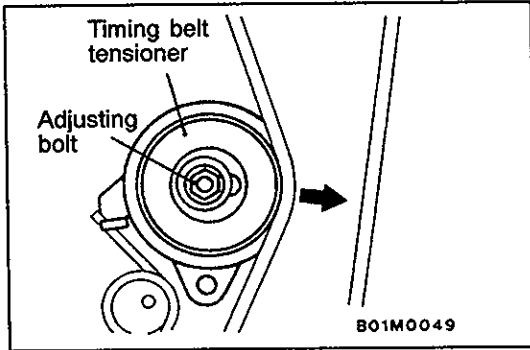
1. Put the protrusion of the timing belt tensioner on the end (A) of the tensioner spring as shown.
2. Move the timing belt tensioner close to the water pump, and temporarily tighten the adjusting bolt.
3. Put a screwdriver in (C), push the protrusion (B) of the tensioner spring in the shown direction, and place it on the stopper (D) of the oil pump case.



4. Align each of the camshaft sprocket and the crankshaft sprocket timing marks.
5. Install the timing belt in the following order, while making sure that the tension side of the belt is not slackened.
 - (1) Crankshaft sprocket
 - (2) Camshaft sprocket
 - (3) Tensioner pulley

Caution

After installing the timing belt, apply force to turn the camshaft sprocket in the reverse direction, and recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.

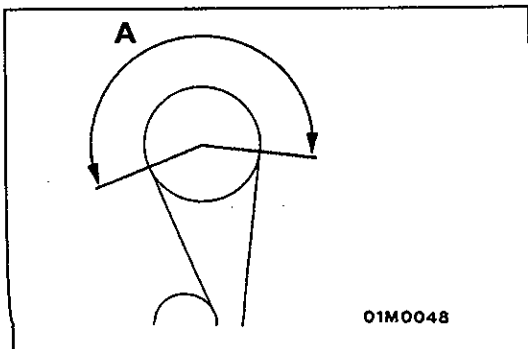


▶B◀ TIMING BELT TENSION ADJUSTMENT

1. Initially loosen the adjusting bolt of the timing belt tensioner fixed to the water pump side by 1/2 – 1/4 turn, and use the force of the tensioner spring to apply tension to the belt.
2. Turn the crankshaft in the proper rotation direction (right turn) for two rotations, and recheck to be sure that the timing marks on each sprocket are aligned.

Caution

As the purpose of this procedure is to apply the proper amount of tension to the tension side of the timing belt by using the cam driving torque, turn the crankshaft only by the amount given above. Be sure not to turn the crankshaft in the opposite direction (left turn).



3. After checking to be sure that no belt teeth in the section marked with A are lifted up and that the teeth in each sprocket are engaged, secure the tensioner pulley.

ENGINE ASSEMBLY

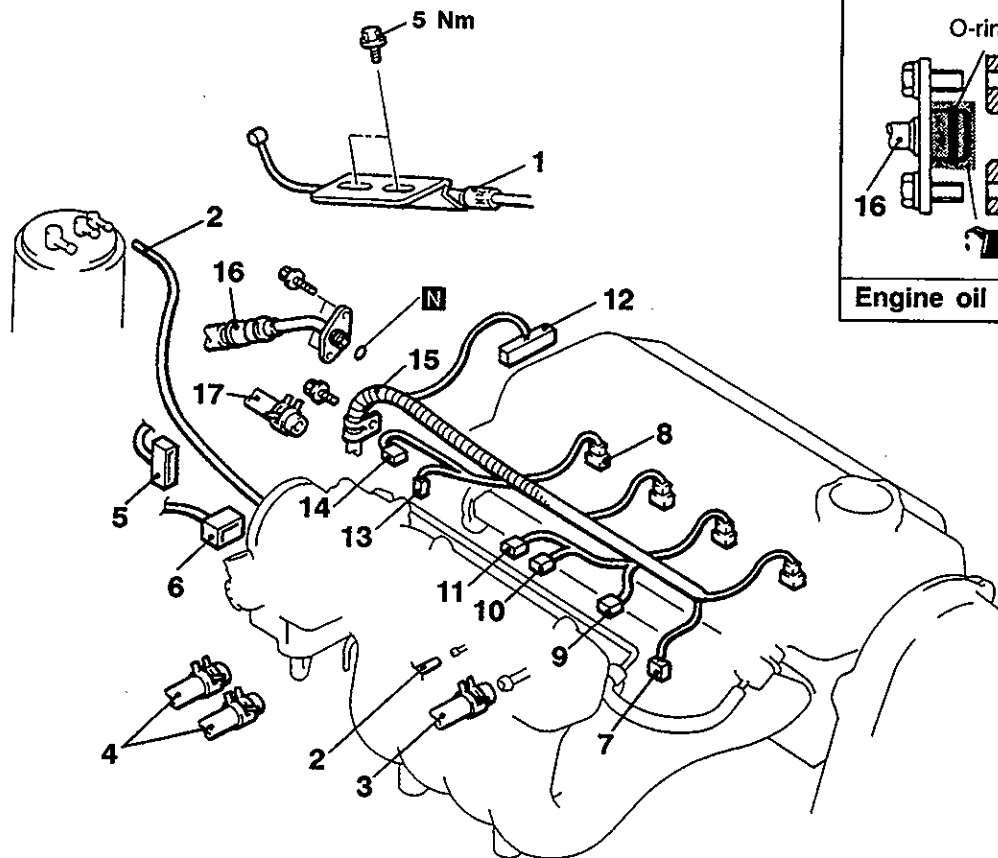
REMOVAL AND INSTALLATION

Pre-removal Operation

- Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.)
- Under Cover Removal
- Hood Removal (Refer to GROUP 42.)
- Air Cleaner Removal
- Radiator Removal (Refer to GROUP 14.)
- Front Exhaust Pipe Removal (Refer to GROUP 15.)

Post-installation Operation

- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Radiator Installation (Refer to GROUP 14.)
- Air Cleaner Installation
- Hood Installation (Refer to GROUP 42.)
- Under Cover Installation
- Drive Belt Tension Adjustment (Refer to P.11A-6.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)

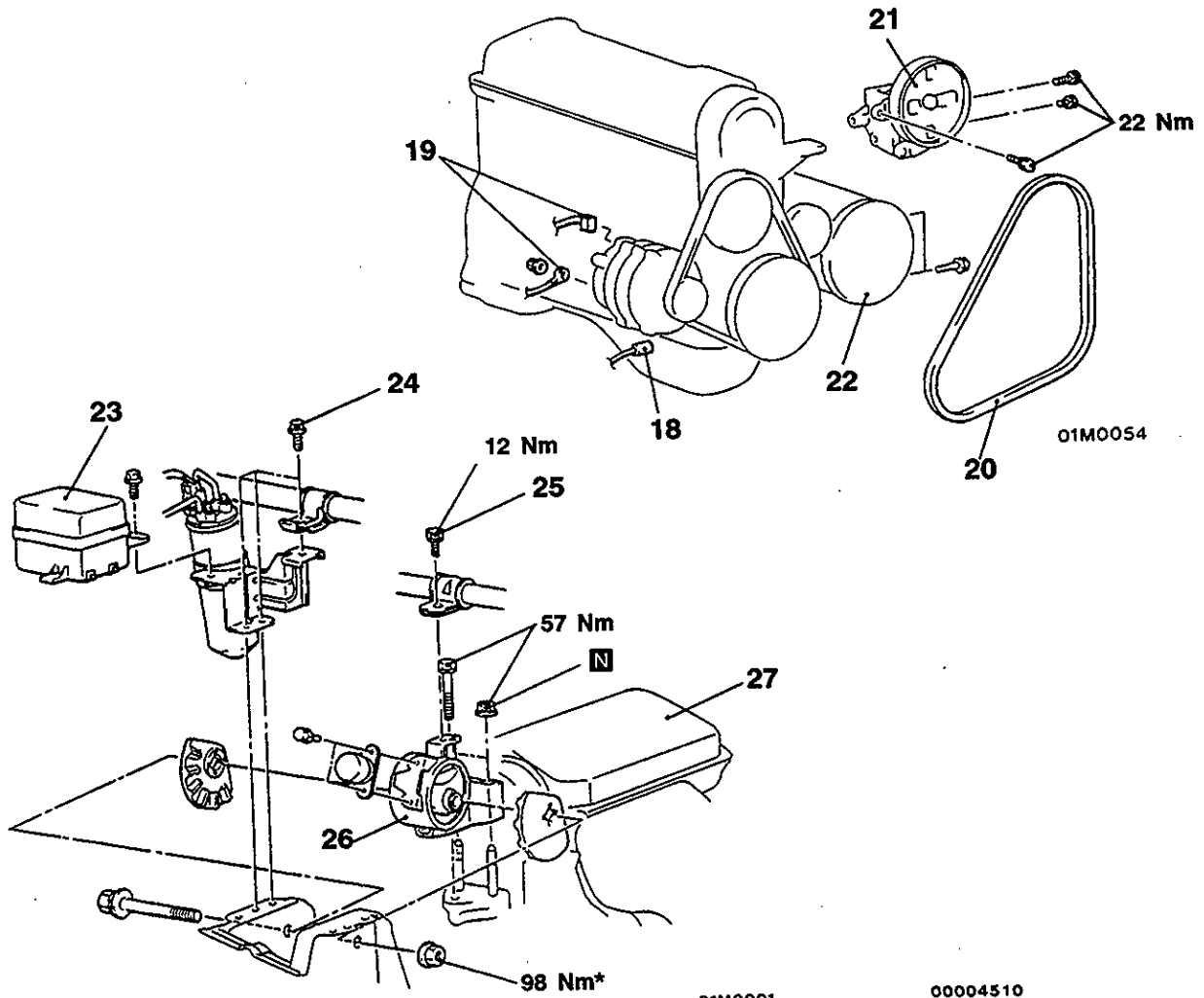


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Removal steps

1. Accelerator cable connection
2. Vacuum hose connection
3. Brake booster vacuum hose connection
4. Heater hose connection
5. Throttle position sensor connector
6. Idle speed control connector
7. Oxygen sensor connector
8. Injector connector
9. Intake air temperature sensor connector
10. Purge control solenoid valve connector
11. EGR solenoid valve connector
12. Distributor connector
13. Engine coolant temperature gauge unit connector
14. Engine coolant temperature sensor connector
15. Control wiring harness
- ▶◀ 16. High-pressure fuel hose connection
17. Fuel return hose connection



- 18. Oil pressure switch connector
- 19. Alternator connector
- 20. Drive belt (Power steering and A/C)
- 21. Power steering oil pump and bracket assembly
- 22. Air conditioner compressor
 - Transmission assembly (M/T: Refer to GROUP 22)
 - (A/T: Refer to GROUP 23)
- 23. Air conditioner relay box

- 24. Air conditioner receiver bracket mounting bolts
- 25. Power steering hose mounting bolt
- 26. Engine mount bracket
- 27. Engine assembly



Caution
 Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

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

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

NOTE

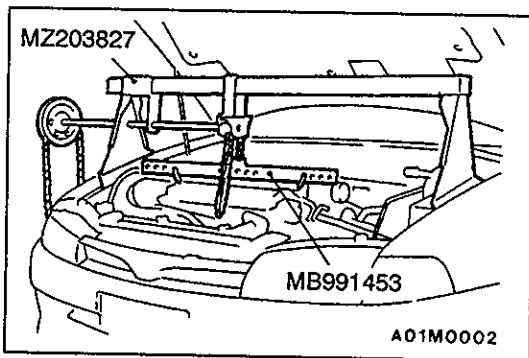
Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀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 where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

**◀C▶ ENGINE MOUNT BRACKET REMOVAL**

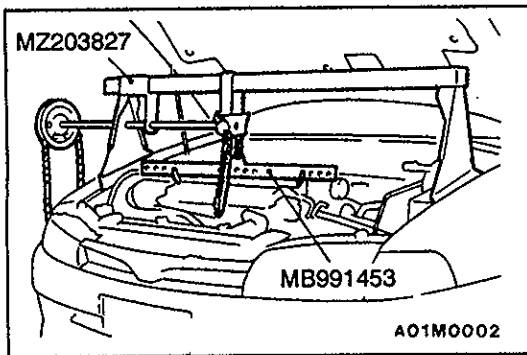
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so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

◀D▶ ENGINE ASSEMBLY REMOVAL

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

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

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

**►B◄ ENGINE MOUNT 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 INSTALLATION

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

Caution

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

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

NOTES

ENGINE <4G9>

CONTENTS

11109000290

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GENERAL INFORMATION

11100010193

Items		4G92	
Total displacement mℓ		1,597	
Bore × Stroke mm		81.0 × 77.5	
Compression ratio		10.0	
Combustion chamber		Pentroof type	
Camshaft arrangement		SOHC	
Number of valve	Intake	8	
	Exhaust	8	
Valve timing	Intake	Opening	BTDC 20°
		Closing	ABDC 42°
	Exhaust	Opening	BBDC 54°
		Closing	ATDC 2°
Fuel system		Electronically controlled multipoint fuel injection	
Rocker arm		Roller type	
Auto-lash adjuster		Not equipped	

SERVICE SPECIFICATIONS

11100030243

Items		Standard value	Limit
Alternator drive belt tension	Tension N	When checked	294–490
		When a used belt is installed	343–441
		When a new belt is installed	490–686
	Deflection (Reference value) mm	When checked	8.0–10.5
		When a used belt is installed	8.5–10.0
		When a new belt is installed	7.0–8.0
Power steering oil pump and A/C compressor drive belt tension	Tension N	When checked	392–588
		When a used belt is installed	441–539
		When a new belt is installed	637–833
	Deflection (Reference value) mm	When checked	10.0–12.0
		When a used belt is installed	10.0–11.0
		When a new belt is installed	7.0–9.0
Valve clearance (at hot) mm		Intake valve	0.20
		Exhaust valve	0.30

Items		Standard value	Limit
Basic ignition timing		5° BTDC±3°	–
Idle speed r/min	Except MVV	750 ± 100	–
	MVV	700 ± 100	–
CO contents %		0.5 or less	–
HC contents ppm		100 or less	–
Compression pressure (250–400 r/min) kPa		1422	min. 1084
Compression pressure difference of all cylinder kPa		–	max. 100
Intake manifold vacuum kPa		min. 60	–
Cylinder head bolt shank length mm		–	96.4

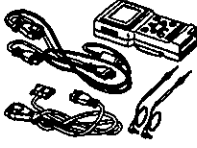
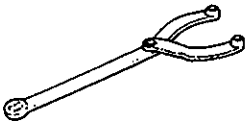
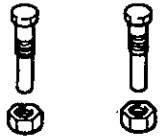
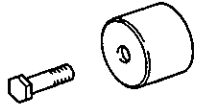
SEALANTS

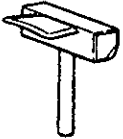
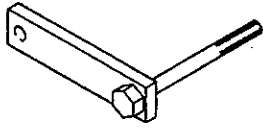
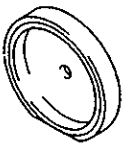
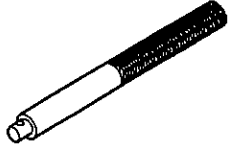
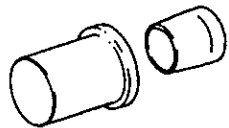
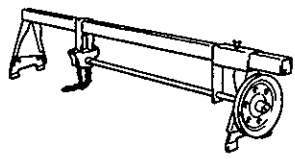
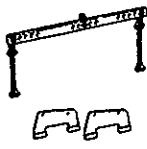
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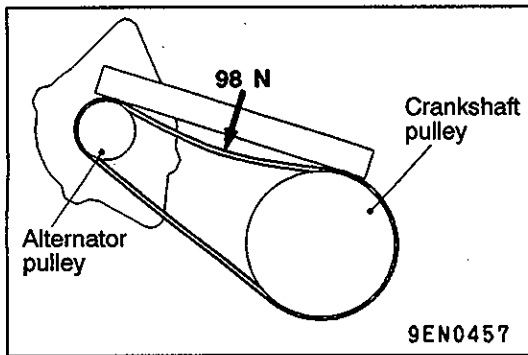
Items	Specified sealants	Remarks
Oil pan Camshaft position sensor support	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Flywheel bolt <M/T> or drive plate bolt <A/T>	3M Stud Locking 4170 or equivalent	–

SPECIAL TOOLS

11100060235

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Checking the idle speed
	MB990767	End yoke holder	<ul style="list-style-type: none"> ● Holding the camshaft sprocket ● Holding the crankshaft pulley
	MD998719 or MD998754	Crankshaft pulley holder pin	
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal

Tool	Number	Name	Use
	MD998727	Oil pan remover	Removal of oil pan
	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	
	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991453	Engine hanger assembly	



ON-VEHICLE SERVICE

11100090265

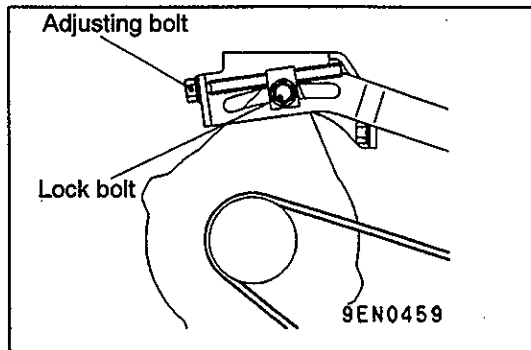
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Use a belt tension gauge to check that the belt tension is at the standard value at a point half-way between the two pulleys as shown in the illustration. In addition, press this section with a force of 98 N and check that the amount of belt deflection is at the standard value.

Standard value:

Tension N	294–490
Deflection (Reference value) mm	8.0–10.5



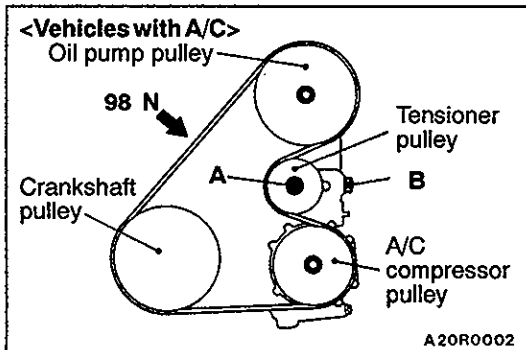
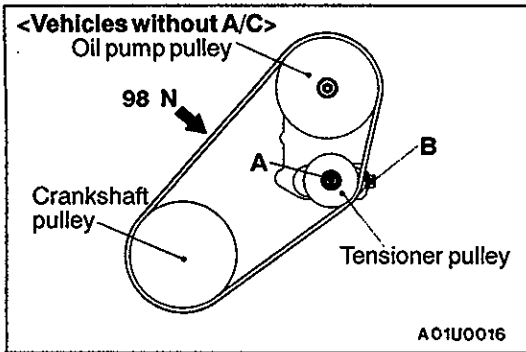
ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

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

Standard value:

Items	When a used belt is installed	When a new belt is installed
Tension N	343–441	490–686
Deflection (Reference value) mm	8.5–10.0	7.0–8.0

4. Tighten the lock bolt.
Tightening torque: 23 Nm
5. Tighten the nut of the alternator pivot bolt.
Tightening torque: 44 Nm
6. Tighten the adjusting bolt.
Tightening torque: 9.8 Nm



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

11100130073

1. Use a belt tension gauge to check that the belt tension is at the standard value at a point half-way between the two pulleys (indicated by an arrow in the illustration). In addition, press this section with a force of 98 N and check that the amount of belt deflection is at the standard value.

Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Tension N	392–588	441–539	637–833
Deflection (Reference value) mm	10.0–12.0	10.0–11.0	7.0–9.0

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

Tightening torque: 25 Nm

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

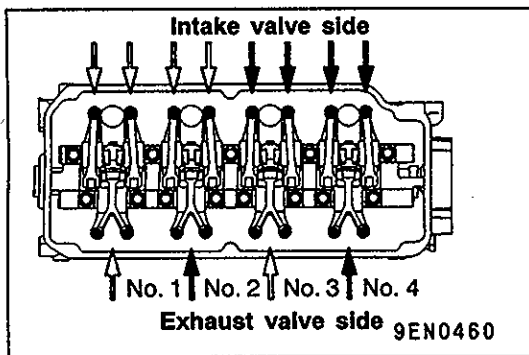
Caution

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

VALVE CLEARANCE CHECK AND ADJUSTMENT

11100150062

1. Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 95°C.
2. Remove all spark plugs from the cylinder head for easy inspection.
3. Remove the rocker cover.
4. Turn the crankshaft clockwise until the notch on the pulley is lined up with the "T" mark on the timing indicator.



5. Move the rocker arms on the No. 1 and No. 4 cylinders up and down by hand to determine which cylinder has its piston at the top dead centre on the compression stroke. If both intake and exhaust valve rocker arms have a valve lash, the piston in the cylinder corresponding to these rocker arms is at the top dead centre on the compression stroke.
6. Valve clearance inspection and adjustment can be performed on rocker arms indicated by white arrow mark when the No. 1 cylinder piston is at the top dead centre on the compression stroke, and on rocker arms indicated by black arrow mark when the No. 4 cylinder piston is at the top dead centre on the compression stroke.
7. Measure the valve clearance.
If the valve clearance is not as specified, loosen the rocker arm lock nut and adjust the clearance using a thickness gauge while turning the adjusting screw.

Standard value (hot engine):

Intake valve: 0.20 mm

Exhaust valve: 0.30 mm

8. While holding the adjusting screw with a screwdriver to prevent it from turning, tighten the lock nut to the specified torque.
9. Turn the crankshaft through 360° to line up the notch on the crankshaft pulley with the "T" mark on the timing indicator.
10. Repeat steps (7) and (8) on other valves for clearance adjustment.
11. Install the rocker cover.
12. Install the spark plugs and tighten to the specified torque.

Tightening torque: 25 Nm

IGNITION TIMING CHECK

11100170105

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

Standard value:

Except MVV: 750 ± 100 r/min

MVV: 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 13A – Troubleshooting.

9. Press the MUT-II clear key (Select a forced driving cancel mode) to release the ACTUATOR TEST.

NOTE

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:

Except MVV: approx. 10° BTDC

MVV: approx. 12° BTDC

NOTE

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

IDLE SPEED CHECK

11100190217

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to OFF and connect the MUT-II to the diagnosis connector.
3. Check the basic ignition timing. Adjust if necessary.

Standard value: 5° BTDC \pm 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.

Curb idle speed:

Except MVV: 750 \pm 100 r/min

MVV: 700 \pm 100 r/min

NOTE

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

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

IDLE MIXTURE CHECK

11100210180

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to OFF 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 \pm 3°

4. Run the engine at 2,500 r/min for 2 minutes.

5. Set the CO, HC tester.
6. Check the CO contents and the HC contents at idle.

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

7. If there is a deviation from the standard value, check the following items:
 - Diagnosis output
 - Closed-loop control (When the closed-loop control is normal, the output signal of the oxygen sensor changes between 0–400 mV and 600–1,000 mV at idle.)
 - Combustion pressure
 - Injector
 - Ignition coil, spark plug cable, spark plug
 - Leak in the EGR system and in the EGR valve
 - Evaporative emission control system
 - Compression pressure

NOTE

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

COMPRESSION PRESSURE CHECK

11100260215

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

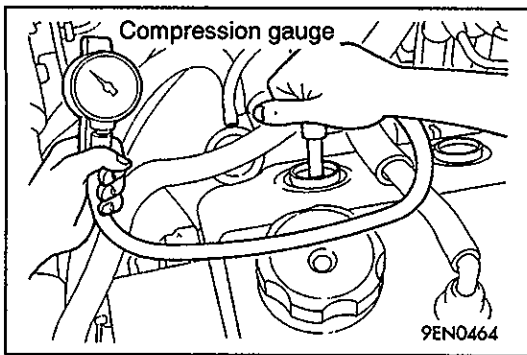
NOTE

Doing this will prevent the engine-ECU 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):
1422 kPa

Limit (at engine speed of 250–400 r/min):
min. 1084 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).

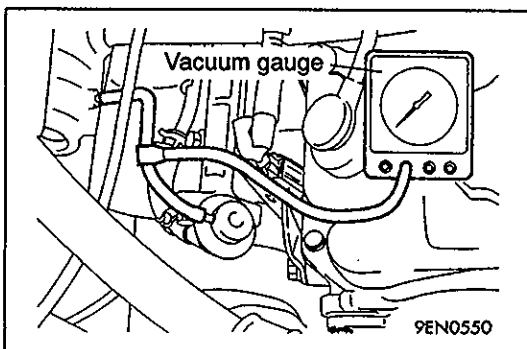
(1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.

(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 distributor 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 distributor connector being disconnected.

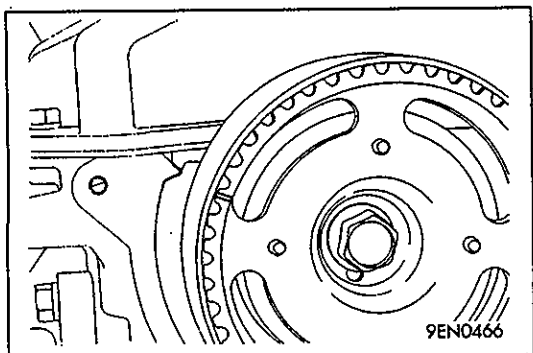


MANIFOLD VACUUM CHECK

11100270072

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

**TIMING BELT TENSION ADJUSTMENT** 11100280075

1. Remove the timing belt upper cover.
2. Turn the crankshaft clockwise to set the No. 1 cylinder to top dead compression centre.

Caution

As the purpose of this procedure is to apply the proper amount of tension to the timing belt by means of the cam drive torque, be sure not to rotate the crankshaft in the opposite direction.

3. Remove the access cover.
4. Loosen the timing belt tensioner fixing bolt to apply tension to the belt by means of the force of the tensioner spring.

Caution

The bolt can be loosened 90°–180°.

If the belt is loosened more than necessary, the bolt may fall in side the cover.

5. Tighten the timing belt tensioner fixing bolt.
6. Install the access cover.
7. Install the timing belt upper cover.

CRANKSHAFT PULLEY

11200160181

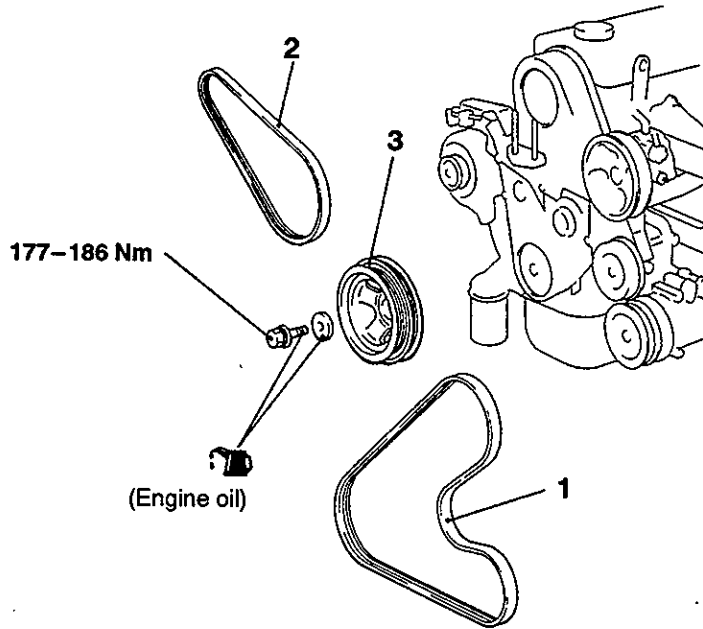
REMOVAL AND INSTALLATION

Pre-removal Operation

- Under Cover Removal

Post-installation Operation

- Drive Belt Tension Adjustment (Refer to P.11B-5.)
- Under Cover Installation

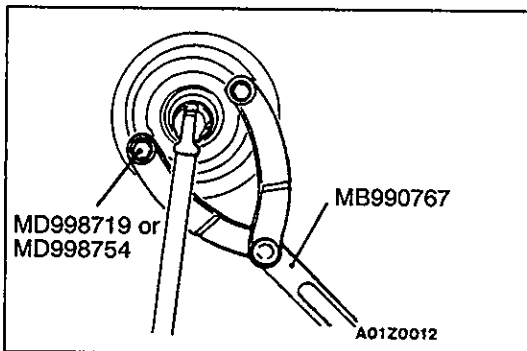


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Removal steps

1. Drive belt (Power steering and A/C)

2. Drive belt (Alternator)
3. Crankshaft pulley



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT PULLEY REMOVAL

INSTALLATION SERVICE POINT

▶A◀ CRANKSHAFT PULLEY INSTALLATION

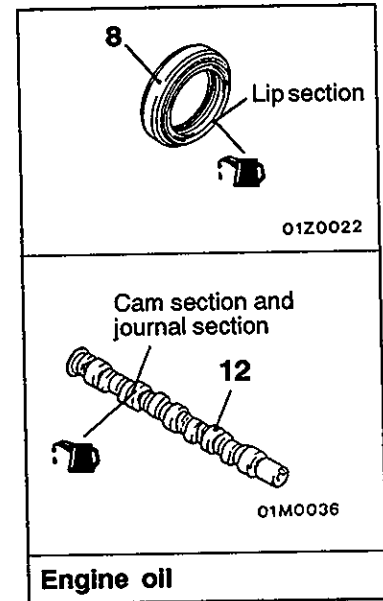
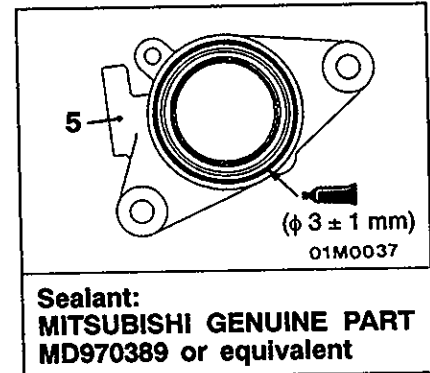
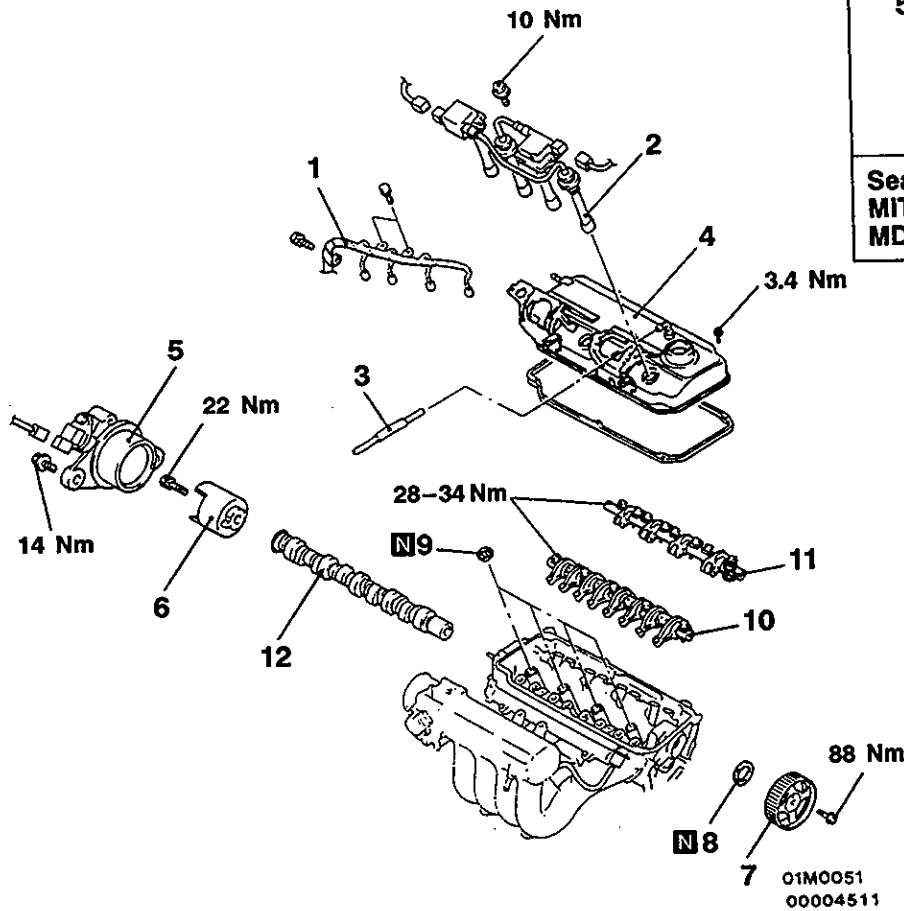
When installing the crankshaft bolt, apply the minimum amount of engine oil to the bearing surface and thread of the bolt.

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- Air Cleaner Removal and Installation
- Timing Belt Removal and Installation (Refer to P.11B-22.)

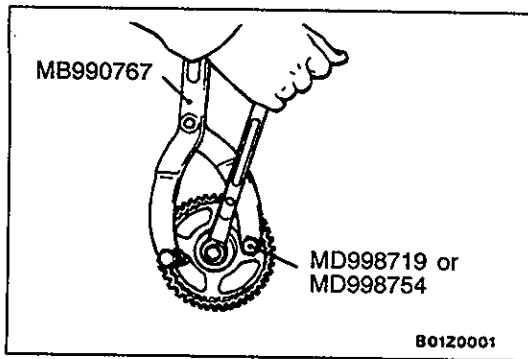
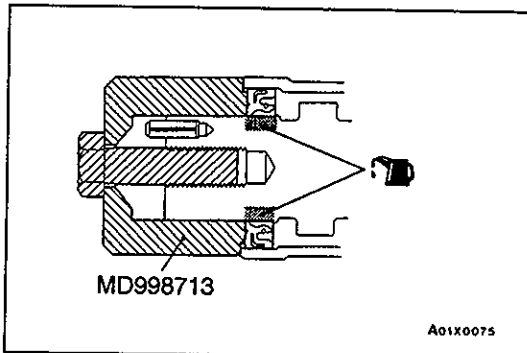


Removal steps

1. Control harness connection
2. Spark plug cable
3. PCV hose connection
4. Rocker cover
 - Valve clearance adjustment (Refer to P.11B-6.)
5. Camshaft position sensor support
6. Camshaft position sensing cylinder



7. Camshaft sprocket
8. Camshaft oil seal
9. Spark plug guide oil seal
10. Rocker arm and shaft assembly (intake side)
11. Rocker arm and shaft assembly (exhaust side)
12. Camshaft

**REMOVAL SERVICE POINT****◀A▶ CAMSHAFT SPROCKET REMOVAL****INSTALLATION SERVICE POINTS****▶A◀ CAMSHAFT OIL SEAL INSTALLATION**

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

▶B◀ CAMSHAFT SPROCKET INSTALLATION

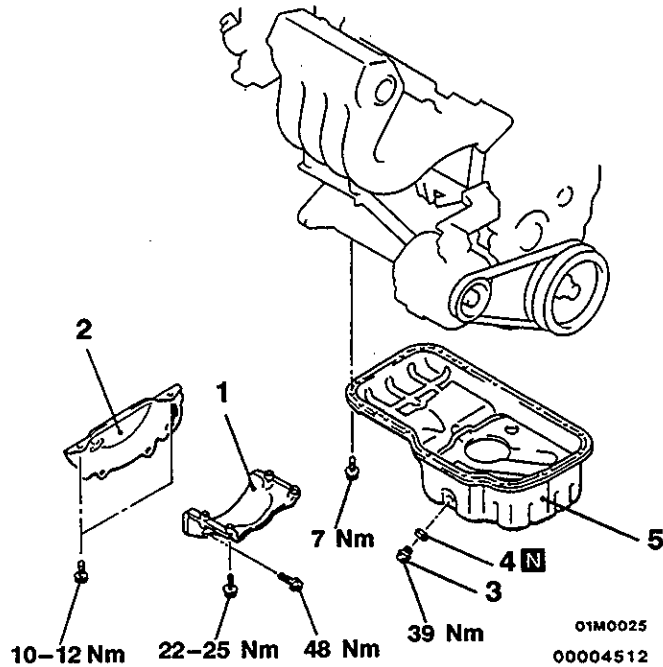
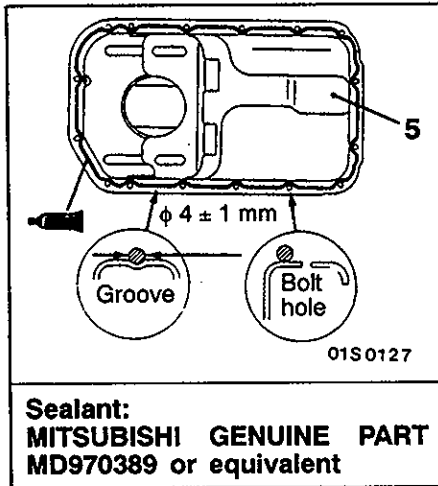
Use the special tool to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

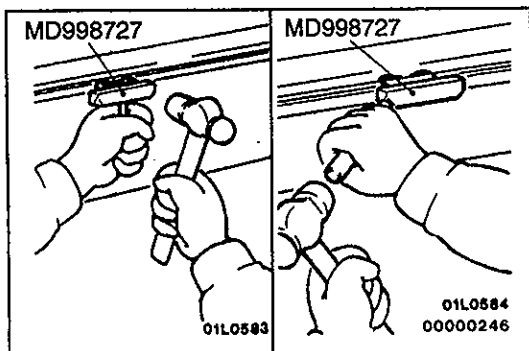
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Oil Level Gauge Removal and Installation
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)



Removal steps

1. Transmission stay
2. Bell housing cover
3. Drain plug

- ▶A◀ 4. Drain plug gasket
▶A◀ 5. Oil pan



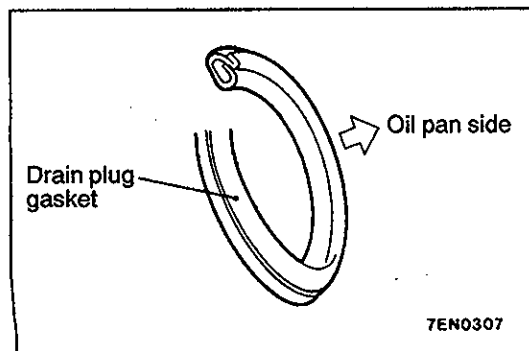
REMOVAL SERVICE POINT

▶A◀ OIL PAN REMOVAL

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

Caution

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

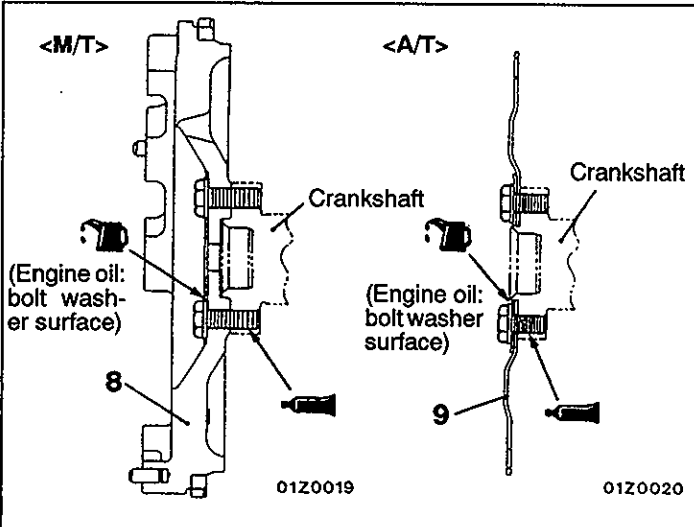
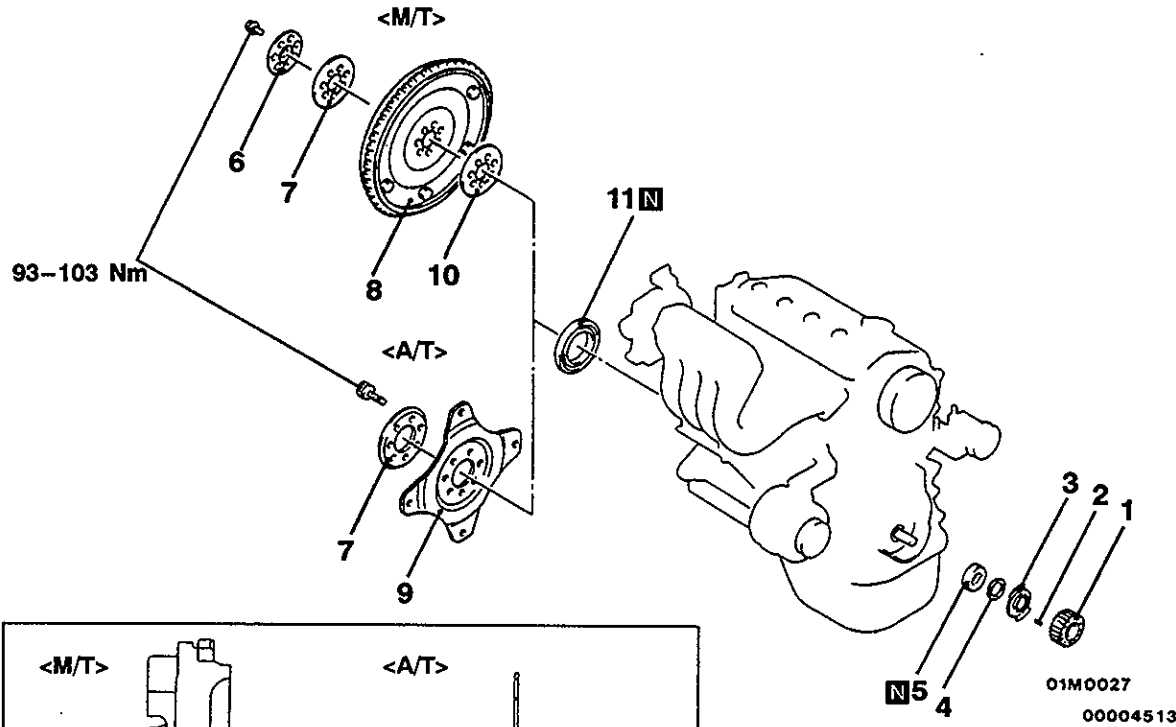


INSTALLATION SERVICE POINT

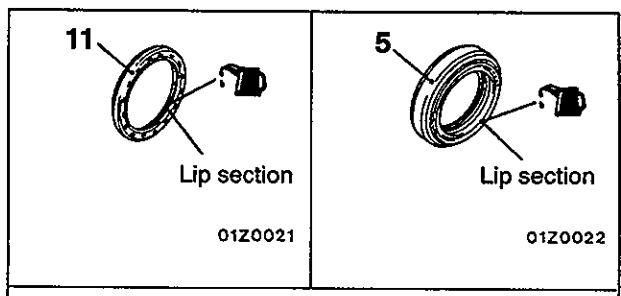
▶A◀ DRAIN PLUG GASKET INSTALLATION

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

CRANKSHAFT OIL SEAL REMOVAL AND INSTALLATION



Sealant: 3M Stud locking 4170 or equivalent



Engine oil

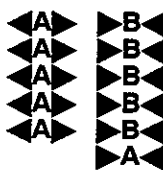
Crankshaft front oil seal removal steps

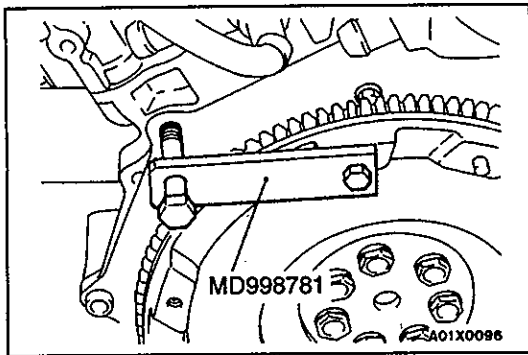
- Timing belt (Refer to P.11B-22.)
- Crank angle sensor (Refer to GROUP 16.)
- 1. Crankshaft sprocket
- 2. Key
- 3. Crankshaft sensing blade
- 4. Crankshaft spacer
- 5. Crankshaft front oil seal



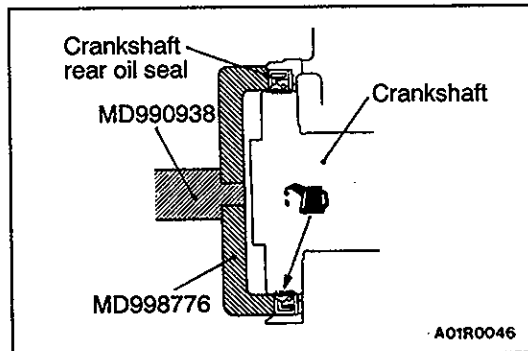
Crankshaft rear oil seal removal steps

- Oil pan (Refer to P.11B-15.)
- Transmission assembly (M/T: Refer to GROUP 22.) (A/T: Refer to GROUP 23.)
- Clutch cover and disc <M/T>
- 6. Plate <M/T>
- 7. Adapter plate
- 8. Flywheel <M/T>
- 9. Drive plate <A/T>
- 10. Adapter plate <M/T>
- 11. Crankshaft rear oil seal



**REMOVAL SERVICE POINT****◀A▶ PLATE <M/T>/ADAPTER PLATE/FLYWHEEL <M/T>/DRIVE PLATE <A/T> REMOVAL**

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

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

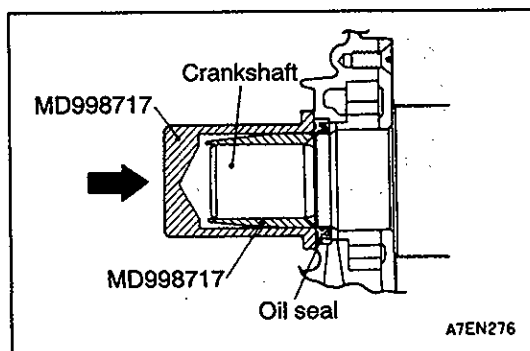
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

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

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

Specified sealant: 3M Stud locking 4170 or equivalent

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

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

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

CYLINDER HEAD GASKET

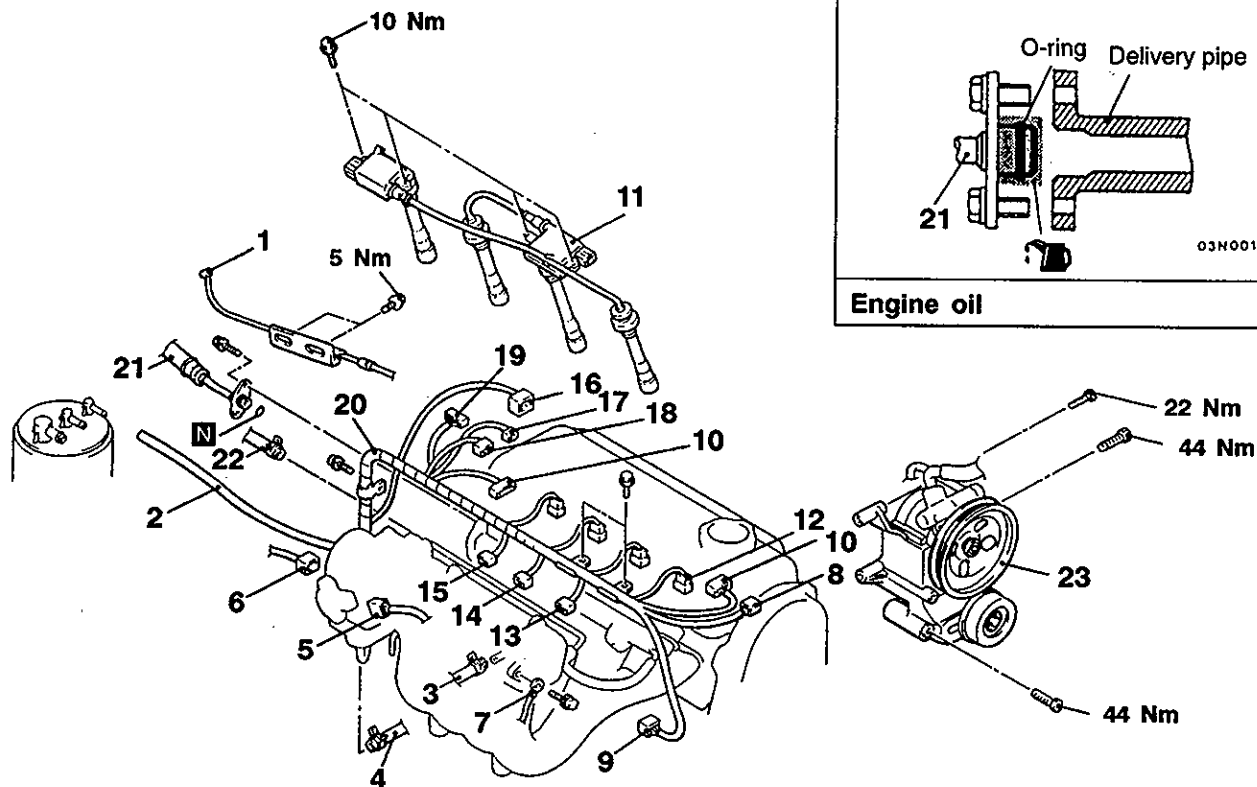
REMOVAL AND INSTALLATION

Pre-removal Operation

- Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.)
- Engine Oil Draining (Refer to GROUP 12 – On-vehicle Service.)
- Thermostat Case Assembly Removal (Refer to GROUP 14 – Water Hose and Water Pipe.)

Post-installation Operation

- Thermostat Case Assembly Installation (Refer to GROUP 14 – Water Hose and Water Pipe.)
- Engine Oil Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)

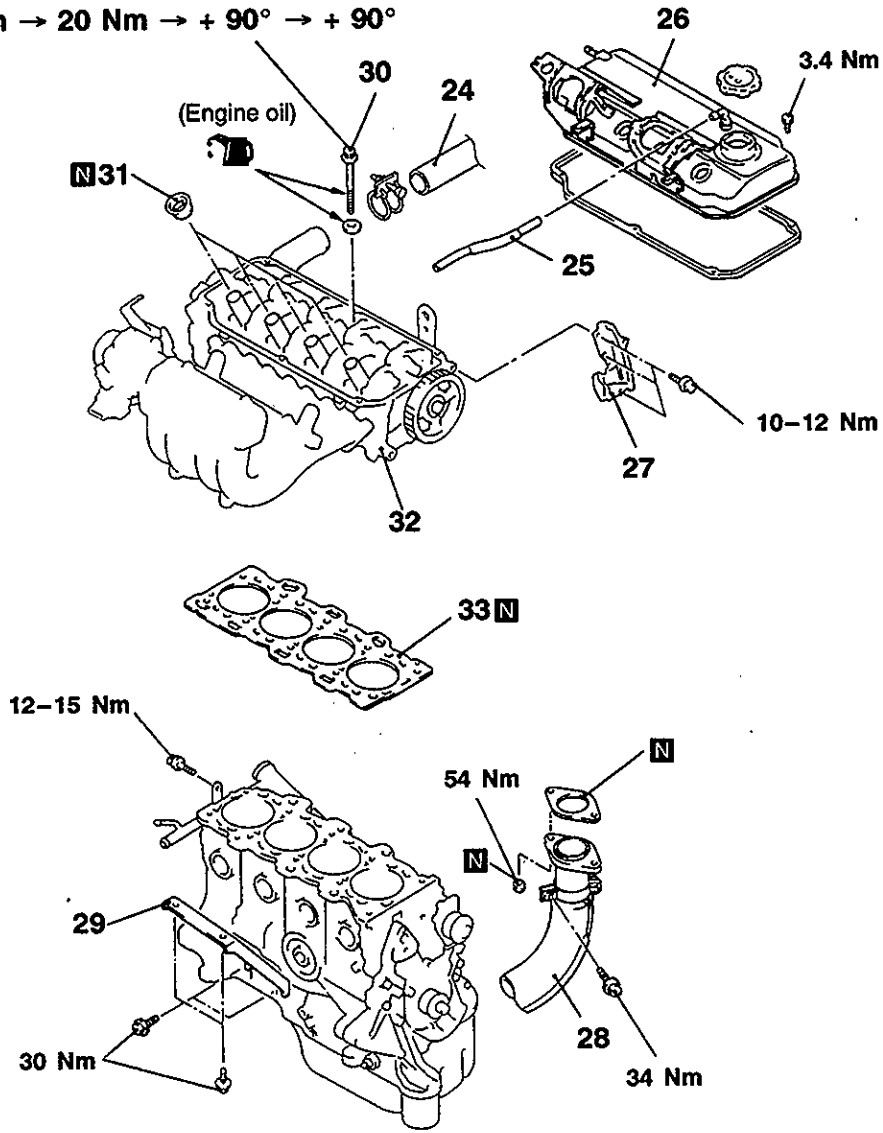
01M0046
00004514**Removal steps**

1. Accelerator cable connection
2. Vacuum hose connection
3. Brake booster vacuum hose connection
4. Water hose connection
5. Throttle position sensor connector
6. Idle speed control connector
7. Earth cable connection
8. Crank angle sensor connector
9. Oxygen sensor connector <Except MVV>
10. Ignition coil connector
11. Ignition coil assembly
12. Injector connector
13. Purge control solenoid valve connector
14. EGR solenoid valve connector
15. Air by-pass solenoid valve connector <MVV>
16. Oxygen sensor connector <MVV>
17. Engine coolant temperature gauge unit connector
18. Engine coolant temperature sensor connector
19. Camshaft position sensor connector
20. Control wiring harness
21. High-pressure fuel hose connection
22. Fuel return hose connection
23. Power steering oil pump and bracket assembly



<Cold engine>

74 Nm → 0 Nm → 20 Nm → + 90° → + 90°



A01M0052

- 24. Radiator upper hose connection
- 25. PCV hose
- 26. Rocker cover
 - Timing belt (Refer to P.11B-22.)
- 27. Timing belt rear cover
- 28. Front exhaust pipe connection

- ◀B▶ ▶B◀ 29. Intake manifold stay
- ▶A◀ 30. Cylinder head bolt
- 31. Spark plug guide oil seal
- 32. Cylinder head assembly
- 33. Cylinder head gasket

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

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

NOTE

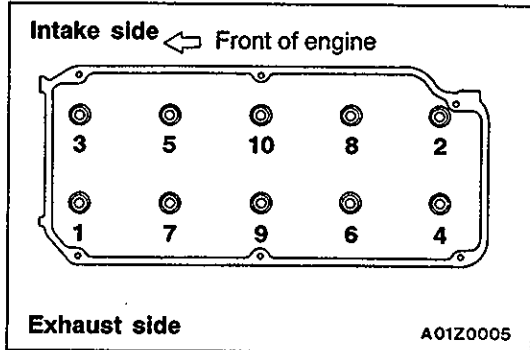
Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the cylinder head assembly, and tie it with a cord.

◀B▶ CYLINDER HEAD BOLT REMOVAL

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

Caution

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

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

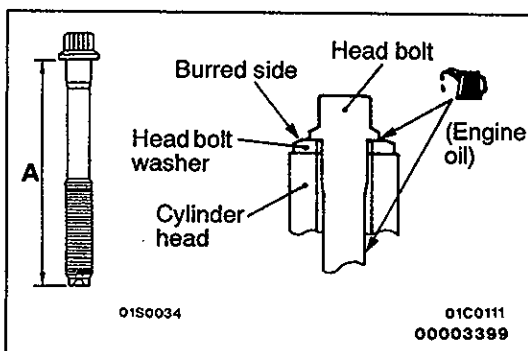
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.

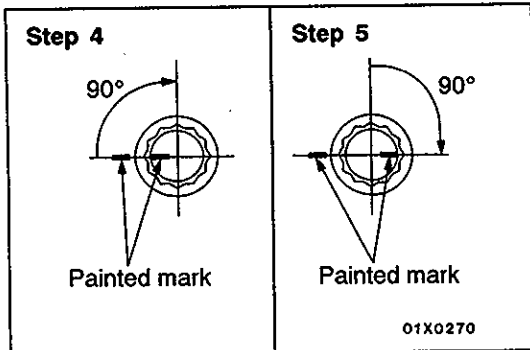
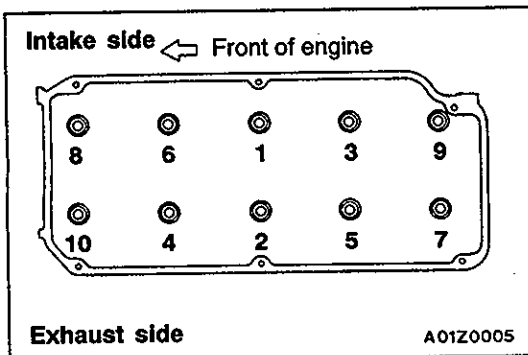
▶B▶ CYLINDER HEAD BOLT INSTALLATION

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

Limit (A): 96.4 mm

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





4. Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 74 Nm.	Carry out in the order shown in the illustration.
2	Fully loosen.	Carry out in the reverse order of that shown in the illustration.
3	Tighten to 20 Nm.	Carry out in the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
5	Tighten 90° of a turn.	In the order shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

Caution

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

►C◄ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

Caution

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

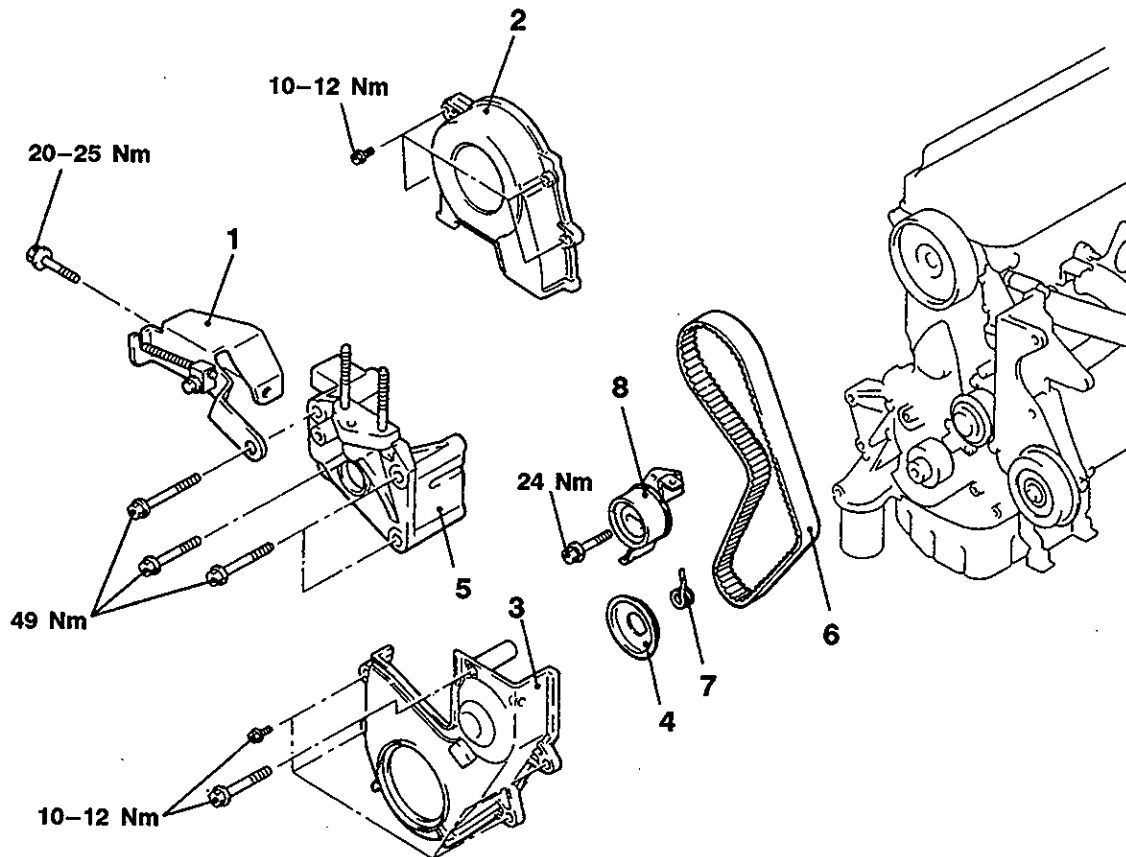
2. While turning the high-pressure fuel hose to the right and left, install the delivery pipe, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably being clamped. Disconnect the high-pressure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

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Crankshaft Pulley Removal and Installation (Refer to P.11B-12.)
- Engine Mount Bracket Removal and Installation (Refer to GROUP 32 – Engine Mounting.)

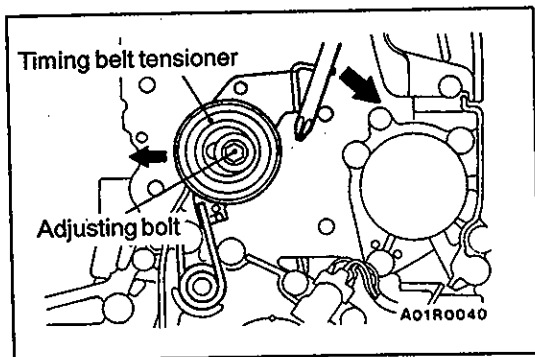
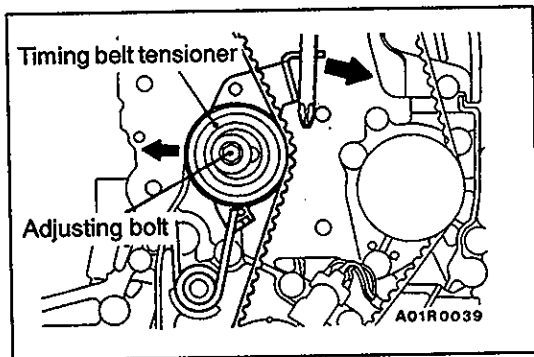
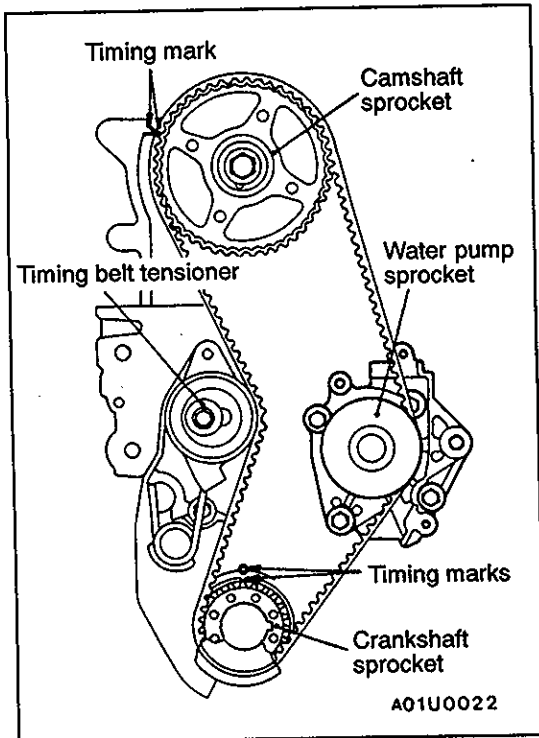


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Removal steps

1. Alternator brace
2. Timing belt upper cover
3. Timing belt lower cover
4. Flange
5. Engine support bracket
- Timing belt tension adjustment
6. Timing belt
7. Tensioner spring
8. Timing belt tensioner





REMOVAL SERVICE POINT

◀▶ TIMING BELT REMOVAL

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

Caution

The crankshaft should always be turned only clockwise.

2. Loosen the adjusting bolt.
3. Set a screwdriver to the timing belt tensioner and press it fully back in the direction of the arrow.
4. Provisionally tighten the adjusting bolt.
5. Remove the timing belt.

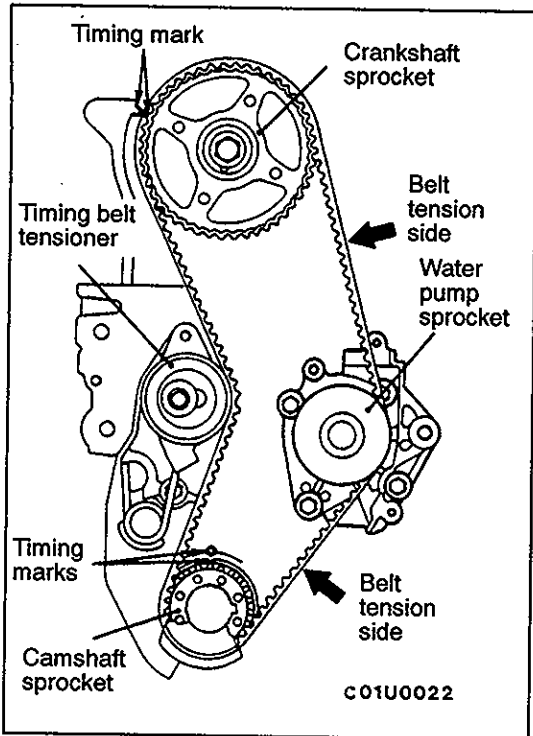
Caution

If the timing belt is to be re-used, use chalk to mark the flat side of the belt with an arrow indicating the direction of rotation (right turn).

INSTALLATION SERVICE POINTS

▶◀ TIMING BELT INSTALLATION

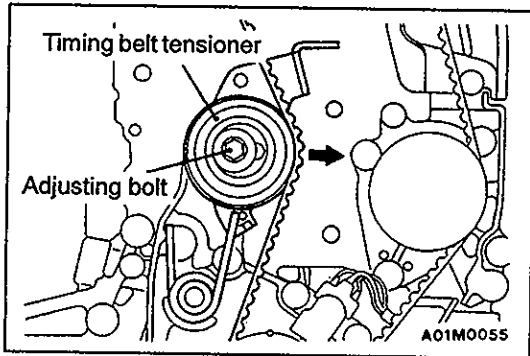
1. Set a screwdriver to the timing belt tensioner and press it fully back in the direction of the arrow.
2. Provisionally tighten the adjusting bolt.



3. Align each of the camshaft sprocket and the crankshaft sprocket timing marks.
4. Install the timing belt in the following order, while making sure that the tension side of the belt is not slackened.
 - (1) Crankshaft sprocket
 - (2) Water pump sprocket
 - (3) Camshaft sprocket
 - (4) Tensioner pulley

Caution

After installing the timing belt, apply force to turn the camshaft sprocket in the reverse direction, and recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.

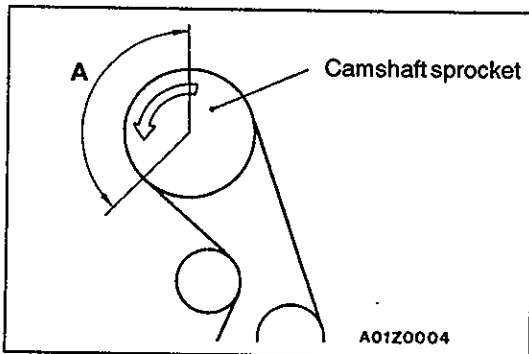


►B◄ TIMING BELT TENSION ADJUSTMENT

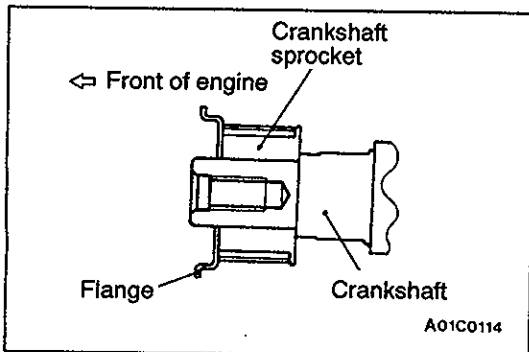
1. Loosen the adjusting bolt of the temporarily secured timing belt tensioner by 1/4 – 1/2 turn, and use the force of the tensioner spring to apply tension to the belt.
2. Turn the crankshaft in the proper rotation direction (right turn) for two rotations, and recheck to be sure that the timing marks on each sprocket are aligned.

Caution

As the purpose of this procedure is to apply the proper amount of tension to the tension side of the timing belt by using the cam driving torque, turn the crankshaft only by the amount given above. Be sure not to turn the crankshaft in the opposite direction (left turn).



3. After checking to be sure that no belt teeth in the section marked with A are lifted up and that the teeth in each sprocket are engaged, secure the tensioner pulley.



►C◄ FLANGE INSTALLATION

Install the flange as shown in the illustration.

ENGINE ASSEMBLY

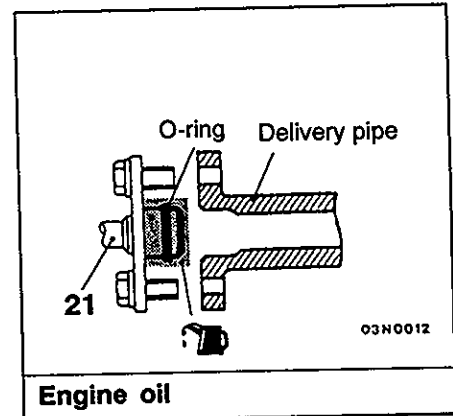
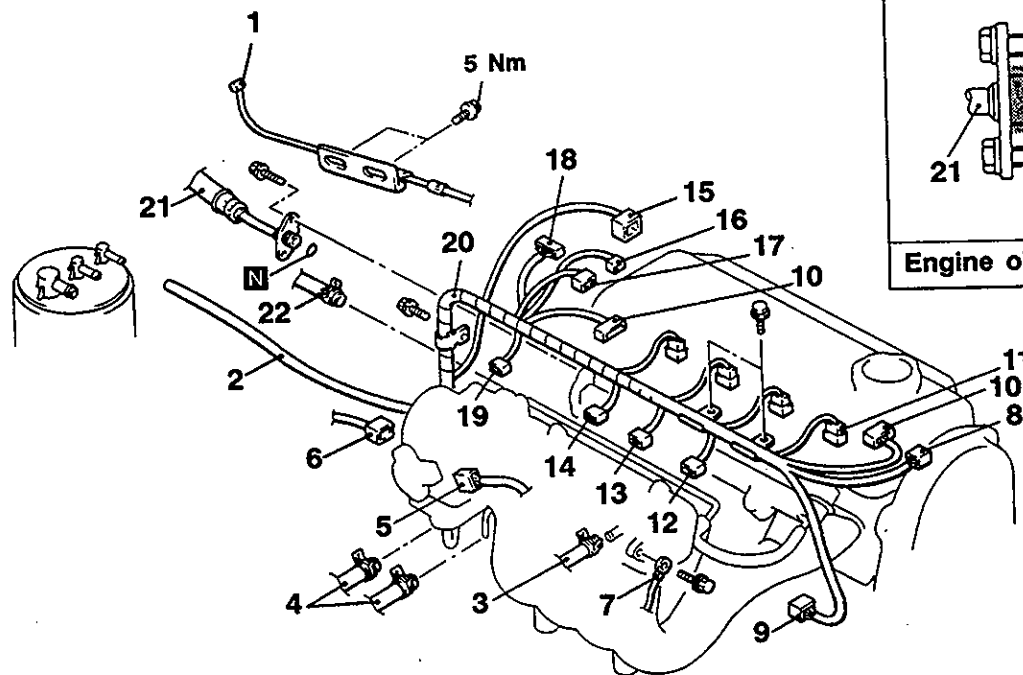
REMOVAL AND INSTALLATION

Pre-removal Operation

- Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.)
- Under Cover Removal
- Hood Removal (Refer to GROUP 42.)
- Air Cleaner Removal
- Radiator Removal (Refer to GROUP 14.)
- Front Exhaust Pipe Removal (Refer to GROUP 15.)

Post-installation Operation

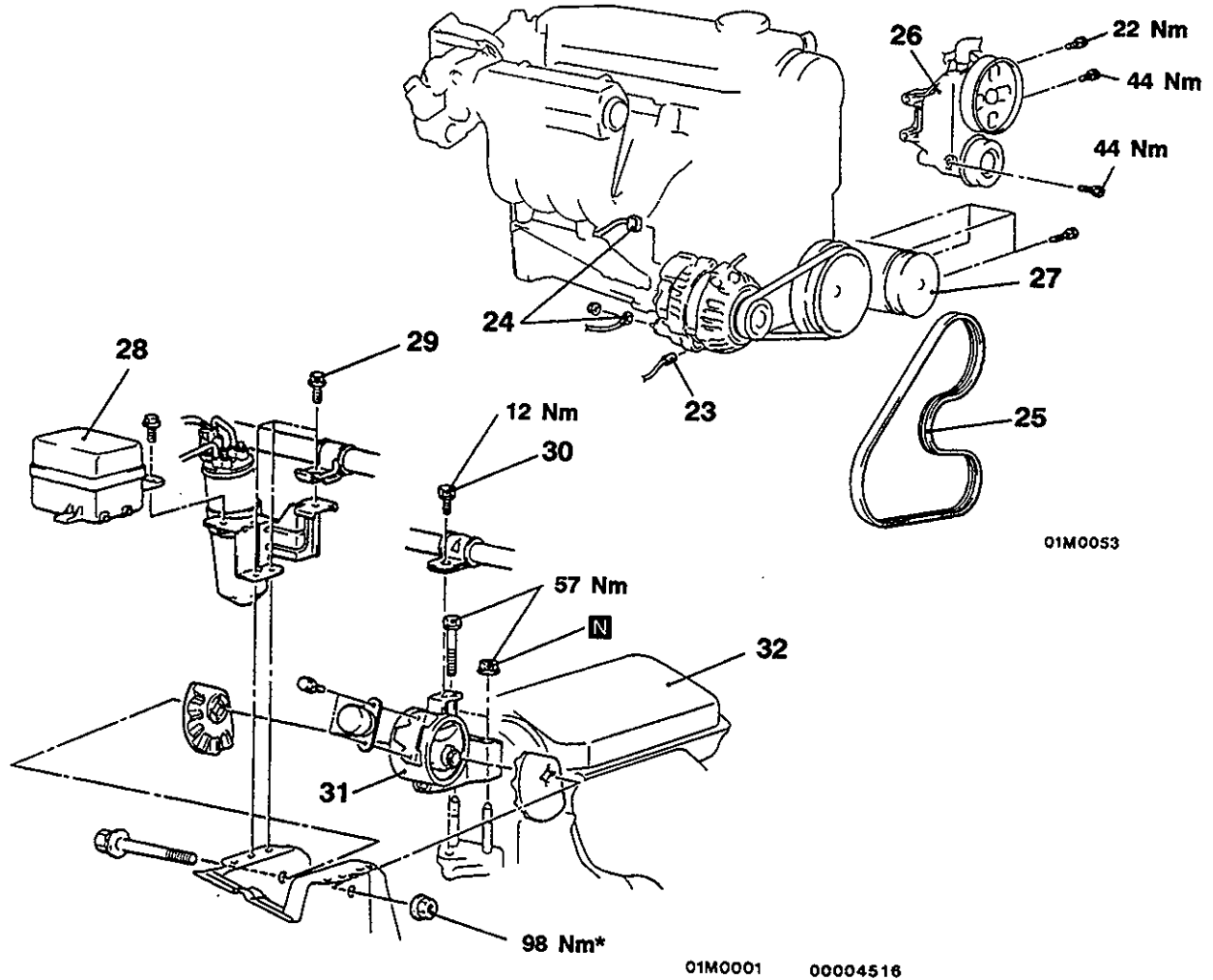
- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Radiator Installation (Refer to GROUP 14.)
- Air Cleaner Installation
- Hood Installation (Refer to GROUP 42.)
- Under Cover Installation
- Drive Belt Tension Adjustment (Refer to P.11B-5.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



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Removal steps

1. Accelerator cable connection
2. Vacuum hose connection
3. Brake booster vacuum hose connection
4. Heater hose connection
5. Throttle position sensor connector
6. Idle speed control connector
7. Earth cable connection
8. Crank angle sensor connector
9. Oxygen sensor connector <Except MVV>
10. Ignition coil connector
11. Injector connector
12. Purge control solenoid valve connector
13. EGR solenoid valve connector
14. Air by-pass solenoid valve connector <MVV>
15. Oxygen sensor connector <MVV>
16. Engine coolant temperature gauge unit connector
17. Engine coolant temperature sensor connector
18. Camshaft position sensor connector
19. Detonation sensor connector
20. Control wiring harness
21. High-pressure fuel hose connection
22. Fuel return hose connection



- 23. Oil pressure switch connector
- 24. Alternator connector
- 25. Drive belt (Power steering and A/C)
- 26. Power steering oil pump and bracket assembly
- 27. Air conditioner compressor
 - Transmission assembly (M/T: Refer to GROUP 22)
 - (A/T: Refer to GROUP 23)
- 28. Air conditioner relay box

- 29. Air conditioner receiver bracket mounting bolts
- 30. Power steering hose mounting bolt
- 31. Engine mount bracket
- 32. Engine assembly



Caution
 Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

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

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

NOTE

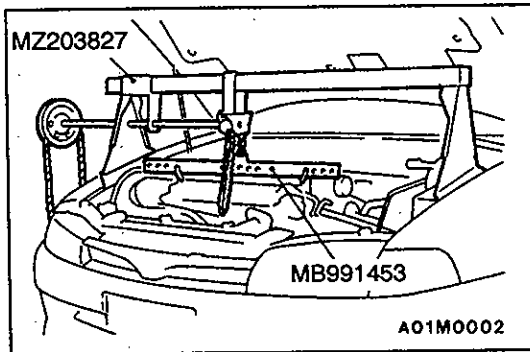
Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀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 where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

**◀C▶ ENGINE MOUNT BRACKET REMOVAL**

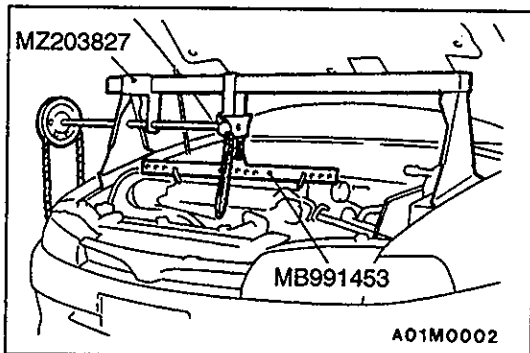
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so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

◀D▶ ENGINE ASSEMBLY REMOVAL

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

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

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

**▶B◀ ENGINE MOUNT 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 INSTALLATION

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

Caution

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

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