
ENGINE

ENGINE <4G1>

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11109000788

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GENERAL INFORMATION

11100010582

Items		4G13	
Total displacement mℓ		1,299	
Bore × Stroke mm		71×82	
Compression ratio		10.0	
Combustion chamber		Pentroof type	
Camshaft arrangement		SOHC	
Number of valve	Intake	8	
	Exhaust	8	
Valve timing	Intake	Opening	BTDC 17°
		Closing	ABDC 39°
	Exhaust	Opening	BBDC 49°
		Closing	ATDC 7°
Fuel system		Electronic control multipoint fuel injection	
Rocker arm		Roller type	
Auto-lash adjuster		Not equipped	

SERVICE SPECIFICATIONS

11100030557

Items			Standard value	Limit
Alternator drive belt tension	Vibration frequency Hz	When checked	150–184	–
		When a used belt is installed	159–176	–
		When a new belt is installed	191–218	–
	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	–

Items			Standard value	Limit
Power steering oil pump and A/C compressor drive belt tension	Vibration frequency Hz	When checked	137–168	–
		When a used belt is installed	145–160	–
		When a new belt is installed	174–199	–
	Tension N	When checked	392–588	–
		When a used belt is installed	441–539	–
		When a new belt is installed	637–834	–
	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	0.30	–	
Basic ignition timing			5° BTDC ± 2°	–
Ignition timing			Approx. 10° BTDC	–
Idle speed r/min			750 ± 100	–
CO contents %			0.5 or less	–
HC contents ppm			100 or less	–
Compression pressure (250–400 r/min) kPa			1,598	Min. 1,161
Compression pressure difference of all cylinder kPa			–	Max. 100
Intake manifold vacuum kPa			–	Min. 60
Cylinder head bolt shank length mm			–	103.2

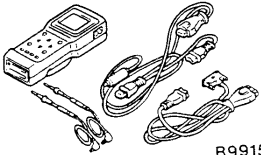
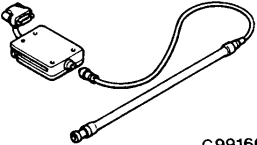
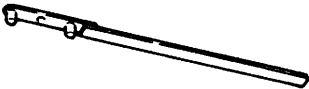
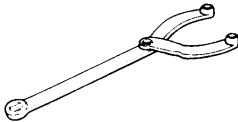
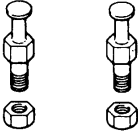
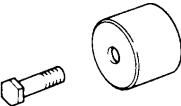
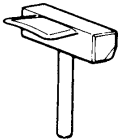
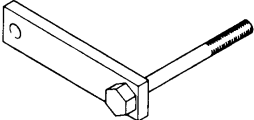
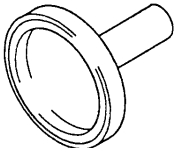
SEALANT

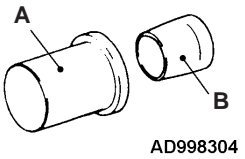
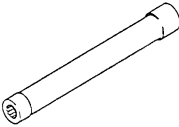
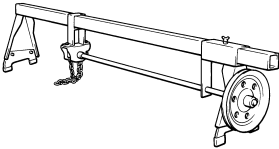

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Items	Specified sealant	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

11100060105

Tool	Number	Name	Use
 <p>B991502</p>	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> Measuring the drive belt tension Checking the idle speed
 <p>C991668</p>	MB991668	Belt tension meter set	Measuring the drive belt tension (used together with MUT-II)
	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
	MD998727	Oil pan remover	Removing the oil pan
	MD998781	Fly wheel stopper	Securing the flywheel
	MD998718	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal

Tool	Number	Name	Use
 <p>AD998304</p>	A: MD998304 B: MD998305	A: Crankshaft front oil seal installer B: Crankshaft front oil seal guide	Press-fitting the crankshaft front oil seal
	MB991653	Cylinder head bolt wrench	Cylinder head bolt removal and installation
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991453	Engine hanger assembly	

ON-VEHICLE SERVICE

11100090500

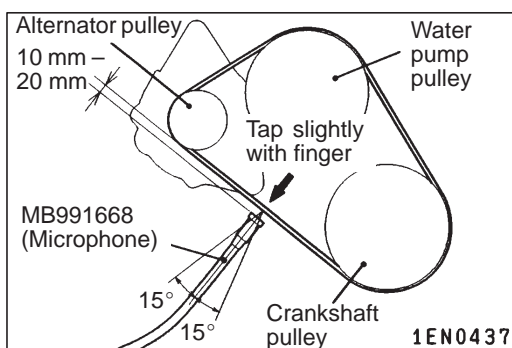
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Check the drive belt tension by the following procedure.

Standard value:

Vibration frequency Hz	150–184
Tension N	392–588
Deflection (Reference value) mm	8.7–11.4



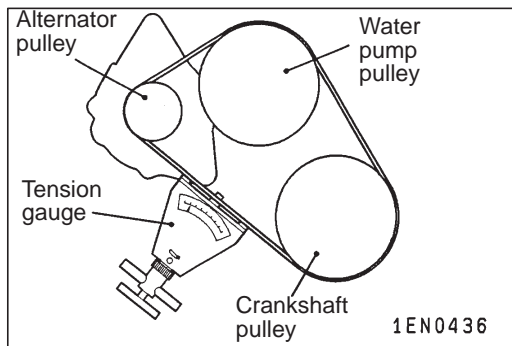
<When using the MUT-II>

1. Connect the special tool (belt tension meter set) to the MUT-II.
2. Connect the MUT-II to the diagnosis connector.
3. Turn the ignition switch to ON and select "Belt Tension Measurement" from the menu screen.

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

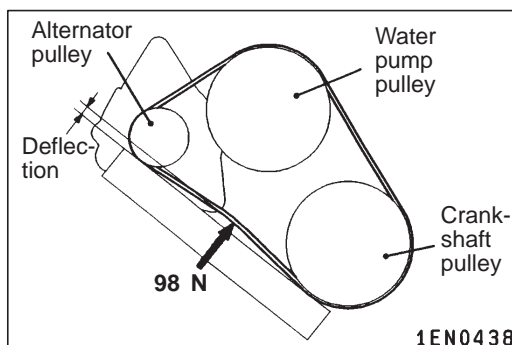
Caution

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



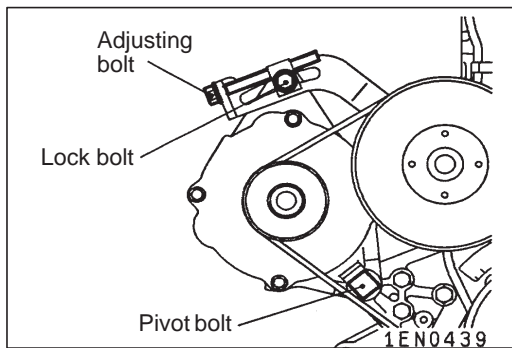
<When using a tension gauge>

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



<Belt deflection check>

Apply 98 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.

**ALTERNATOR DRIVE BELT TENSION ADJUSTMENT**

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

Standard value:

Items	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	159–176	191–218
Tension N	441–539	637–833
Deflection (Reference value) mm	9.2–10.6	6.6–8.3

4. Tighten the nut of the alternator pivot bolt.

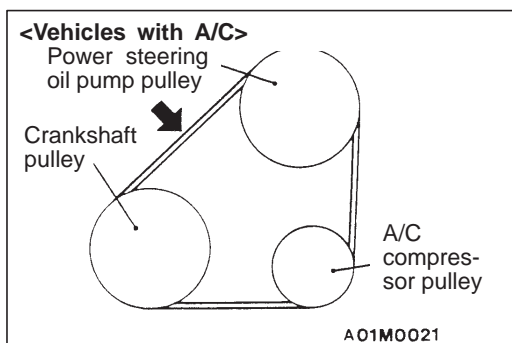
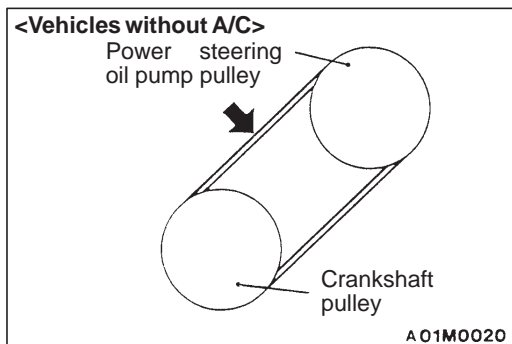
Tightening torque: 44 Nm

5. Tighten the lock bolt.

Tightening torque: 23 Nm

6. Tighten the adjusting bolt.

Tightening torque: 5 Nm

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

11100130189

1. Check the drive belt tension by using the following procedure.

<When using the MUT-II>

Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value range.

NOTE

Refer to P.11B-5 for details on the method of measuring the vibration frequency by using the MUT-II.

<When using a tension gauge>

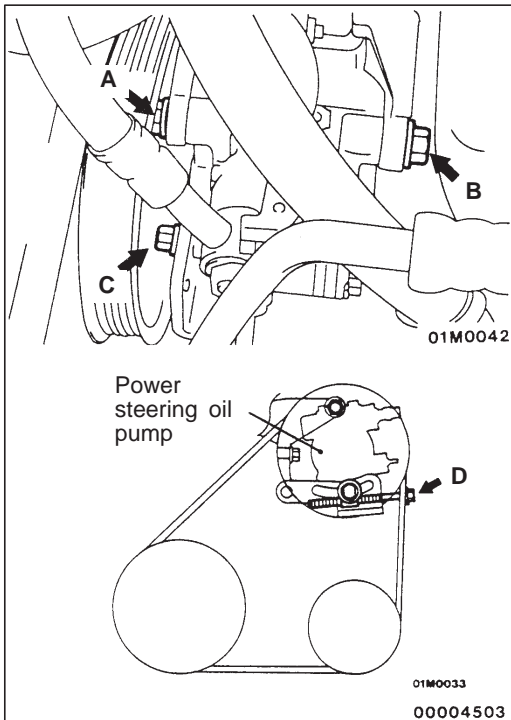
Use a belt tension gauge to check that the belt tension is within the standard value.

<Belt deflection check>

Apply 98 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.

Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	137–168	145–160	174–199
Tension N	392–588	441–539	637–834
Deflection mm	9.6–12.4	10.2–11.6	7.2–9.0



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

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

Tightening torque:

Bolts A and B: 44 Nm

Bolt C: 49 Nm

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

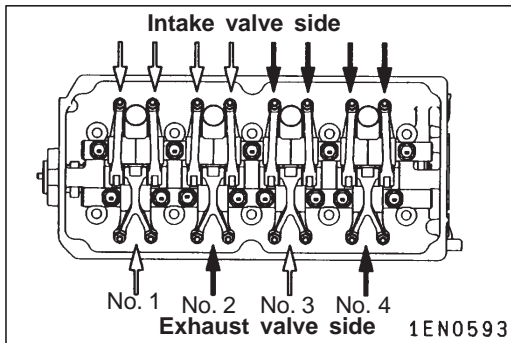
Caution

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

VALVE CLEARANCE CHECK AND ADJUSTMENT

11100150154

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.

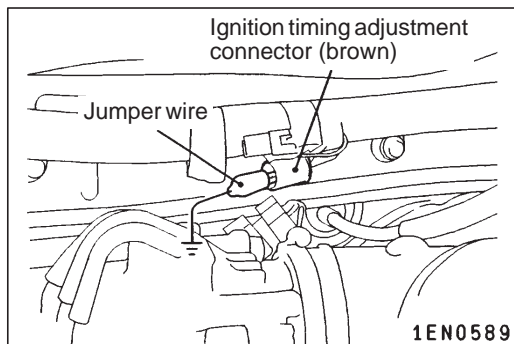
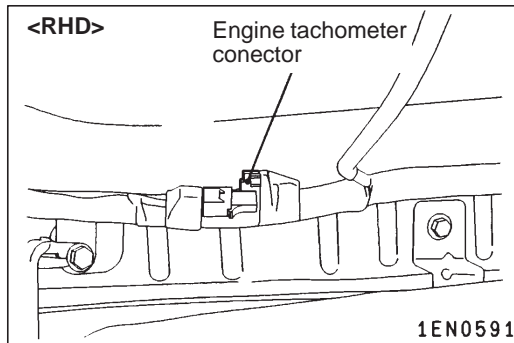
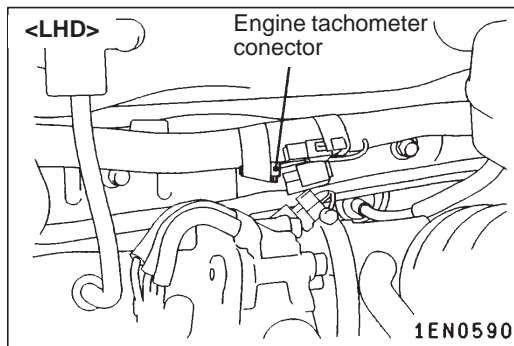
Standard value (hot engine):**Intake valve: 0.25 mm****Exhaust valve: 0.30 mm**

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

Tightening torque: 9 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

11100160331

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Insert a paper clip from the harness side into the engine tachometer connector (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 a 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

11100190521

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Check the basic ignition timing. Adjust if necessary.
Standard value: 5° BTDC ± 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 ± 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 13B – Troubleshooting.

IDLE MIXTURE CHECK

11100210517

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

NOTE

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

COMPRESSION PRESSURE CHECK

11100260642

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.

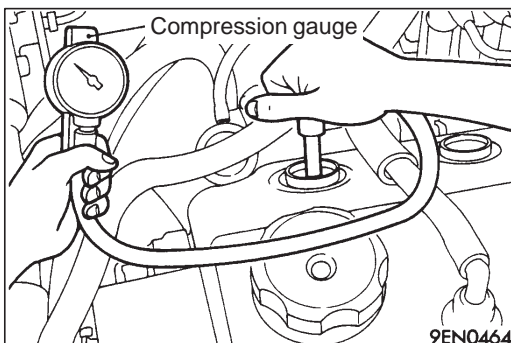
NOTE

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):
1,598 kPa

Limit (at engine speed of 250 – 400 r/min):
min. 1,161 kPa

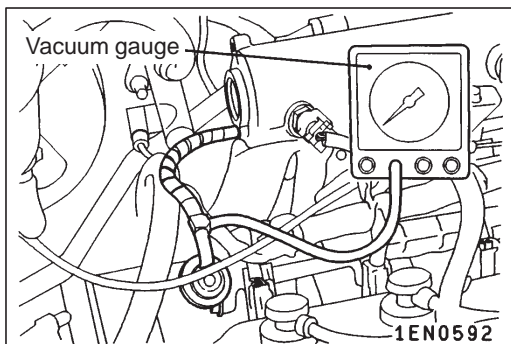
8. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

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 problem code resulting from the distributor connector being disconnected.

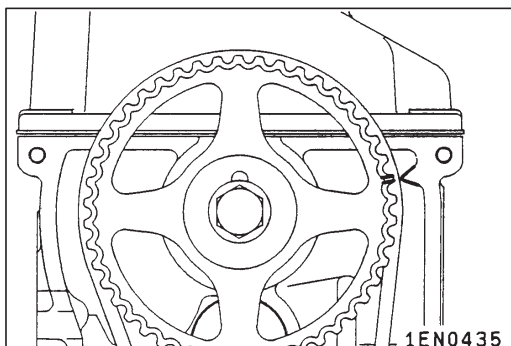


MANIFOLD VACUUM CHECK

11100270546

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

11100280204

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.

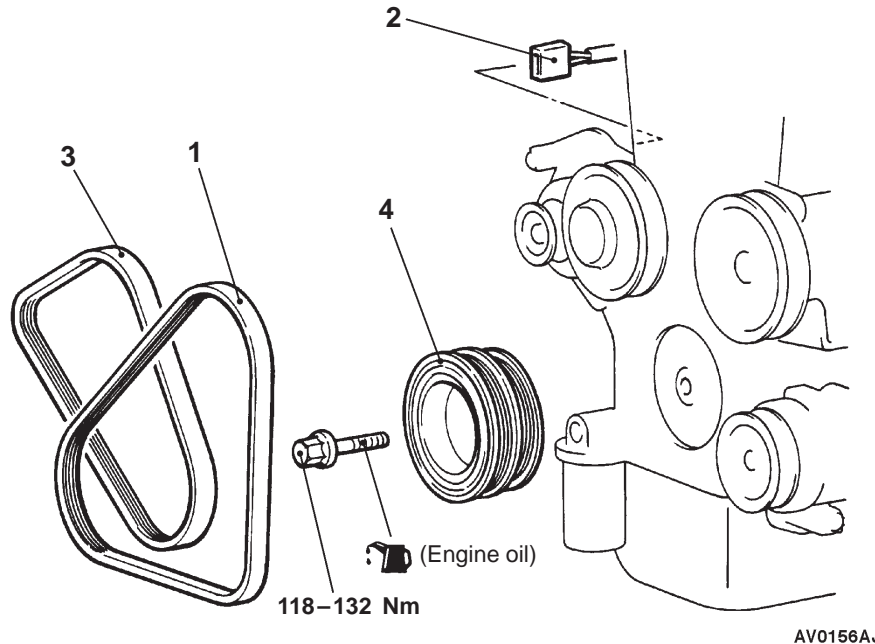
CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover (R.H.) Removal

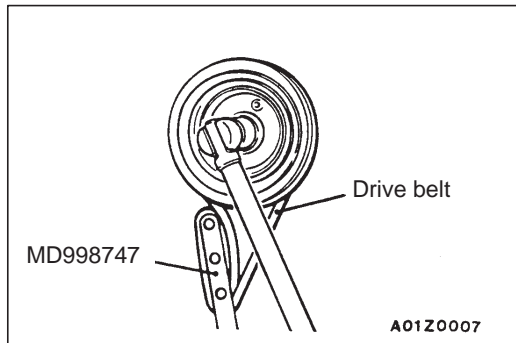
Post-installation Operation

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



Removal steps

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



REMOVAL SERVICE POINT

◀A▶ **CRANKSHAFT PULLEY REMOVAL**

Caution

1. Drive belt will be damaged when doing this work, so do not use the drive belt installed on the engine.
2. Never reuse 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

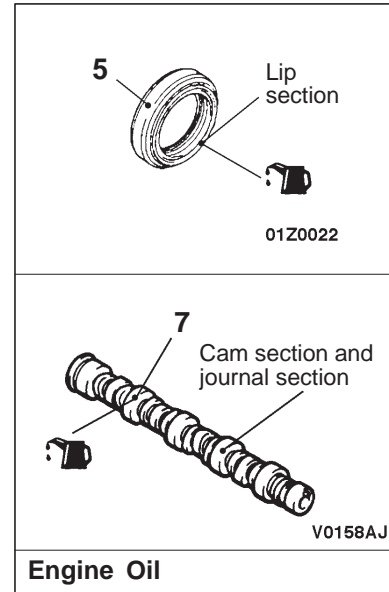
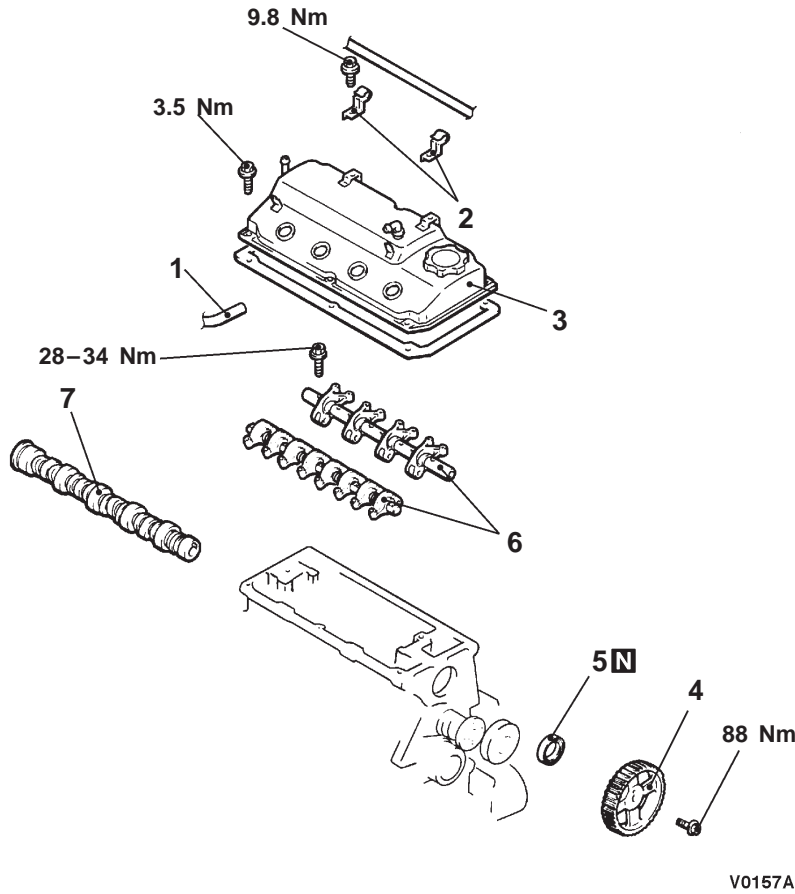
1. Drive belt will be damaged when doing this work, so do not use the drive belt installed on the engine.
2. Never reuse a damaged drive belt.

CAMSHAFT AND CAMSHAFT OIL SEAL

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.11B-25.)



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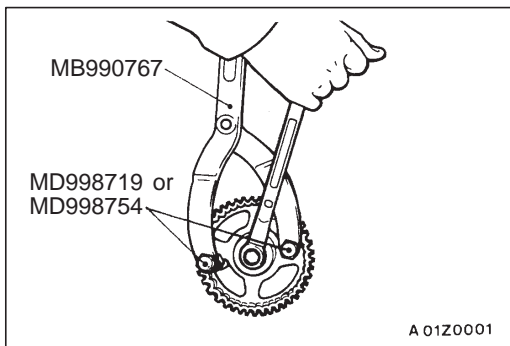
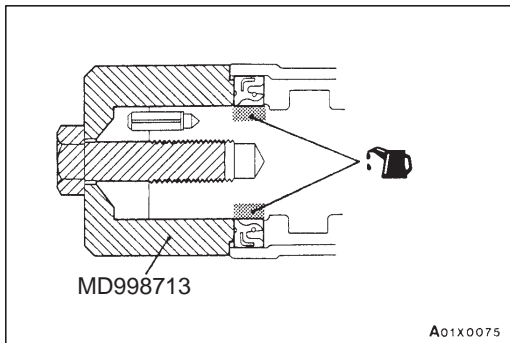
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Removal steps

1. PCV hose connection
2. Accelerator cable clamp
<L.H. drive vehicles>
3. Rocker cover
 - Valve clearance adjustment
(Refer to P.11B-9.)
4. Camshaft sprocket

- ▶A◀
5. Camshaft oil seal
 6. Rocker arm and shaft assembly
 7. Camshaft

◀A▶ ▶B◀

**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

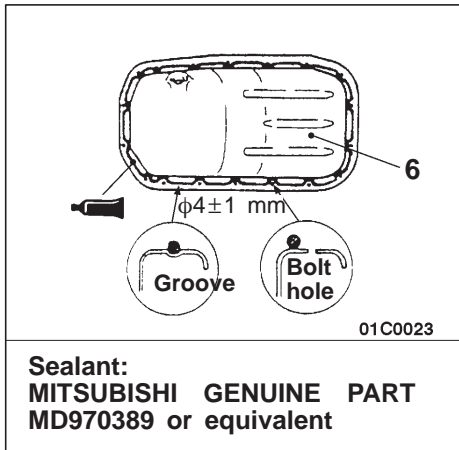
Use the special tool to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

OIL PAN

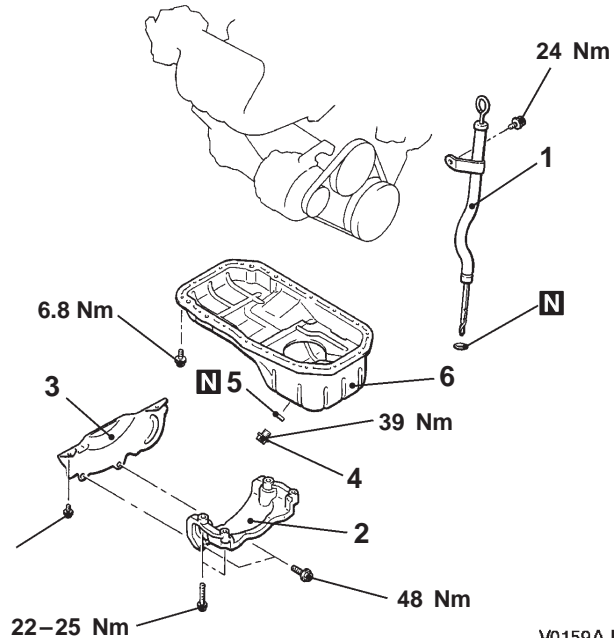
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

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



8.8 Nm <Bolt and washer assembly>
 9.8 Nm <Flange bolt>

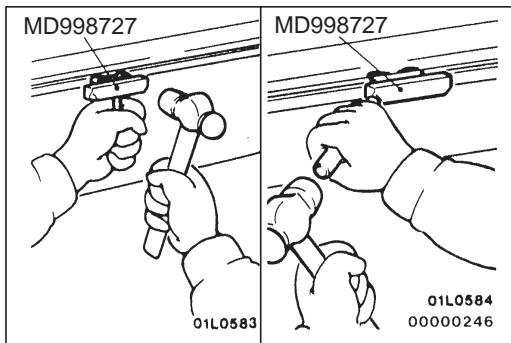


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Removal steps

1. Oil level gauge assembly
2. Transmission stay
3. Bell housing cover

4. Drain plug
5. Drain plug gasket
6. Oil pan



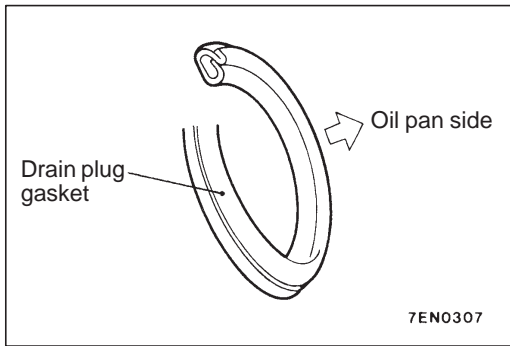
REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

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

Caution

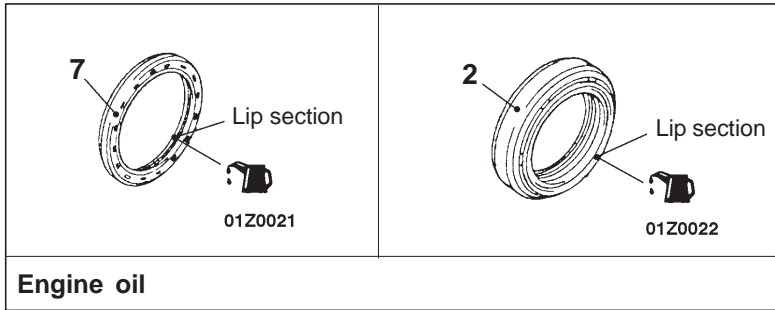
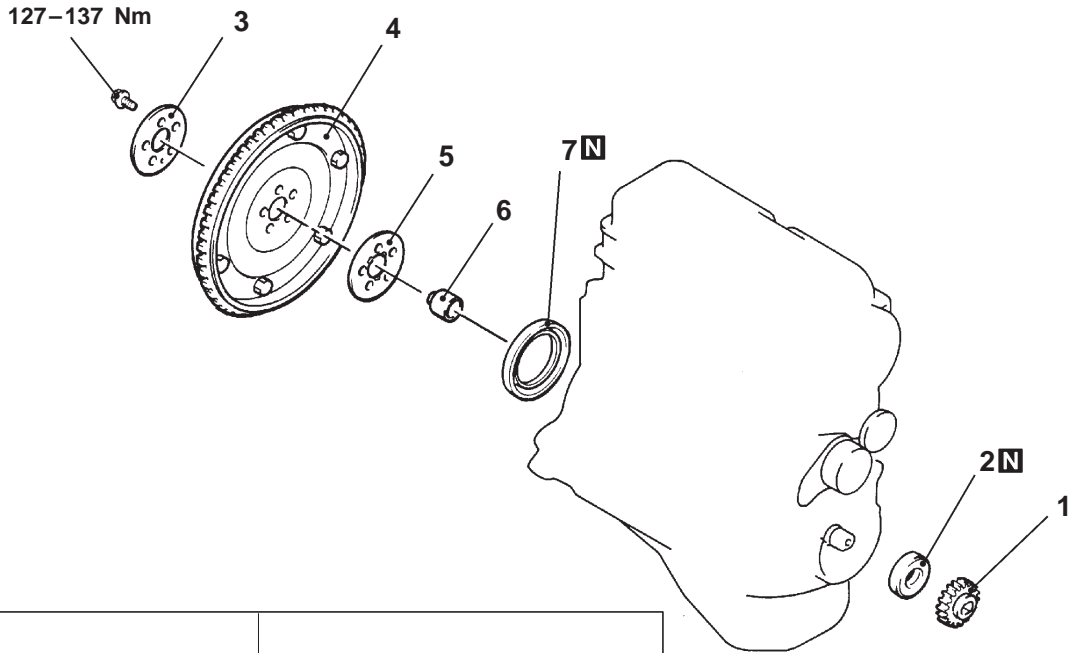
Perform this slowly to avoid deformation of the oil pan flange.

**INSTALLATION SERVICE POINT****▶◀ DRAIN PLUG GASKET INSTALLATION**

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

CRANKSHAFT OIL SEALS

REMOVAL AND INSTALLATION



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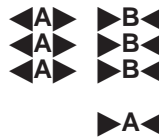
Crankshaft front oil seal removal steps

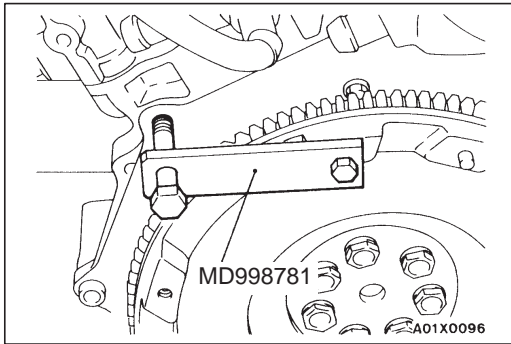
- Timing belt (Refer to P.11B-25.)
- 1. Crankshaft sprocket
- 2. Crankshaft front oil seal



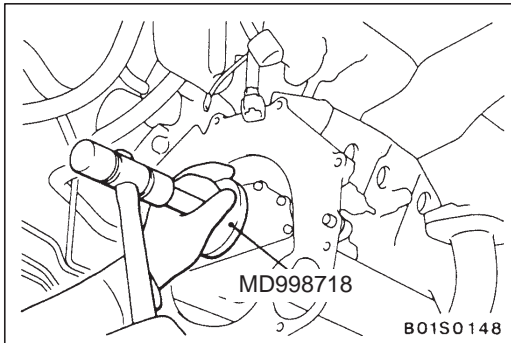
Crankshaft rear oil seal removal steps

- Transmission assembly (Refer to GROUP 22.)
- Clutch cover and disc
- 3. Adapter plate
- 4. Flywheel
- 5. Adapter plate
- 6. Crankshaft bushing
- 7. Crankshaft rear oil seal



**REMOVAL SERVICE POINT****◀A▶ ADAPTER PLATE/FLYWHEEL REMOVAL**

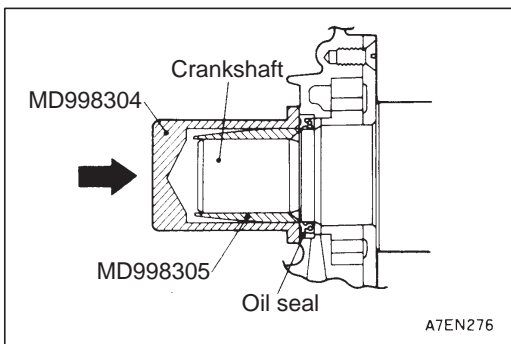
Use the special tool to secure the flywheel, and remove the bolts.

**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 shown in the illustration.

▶B◀ FLYWHEEL/ADAPTER PLATE INSTALLATION

Use the special tool to hold the flywheel in the same manner as removal, and install the bolts.

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

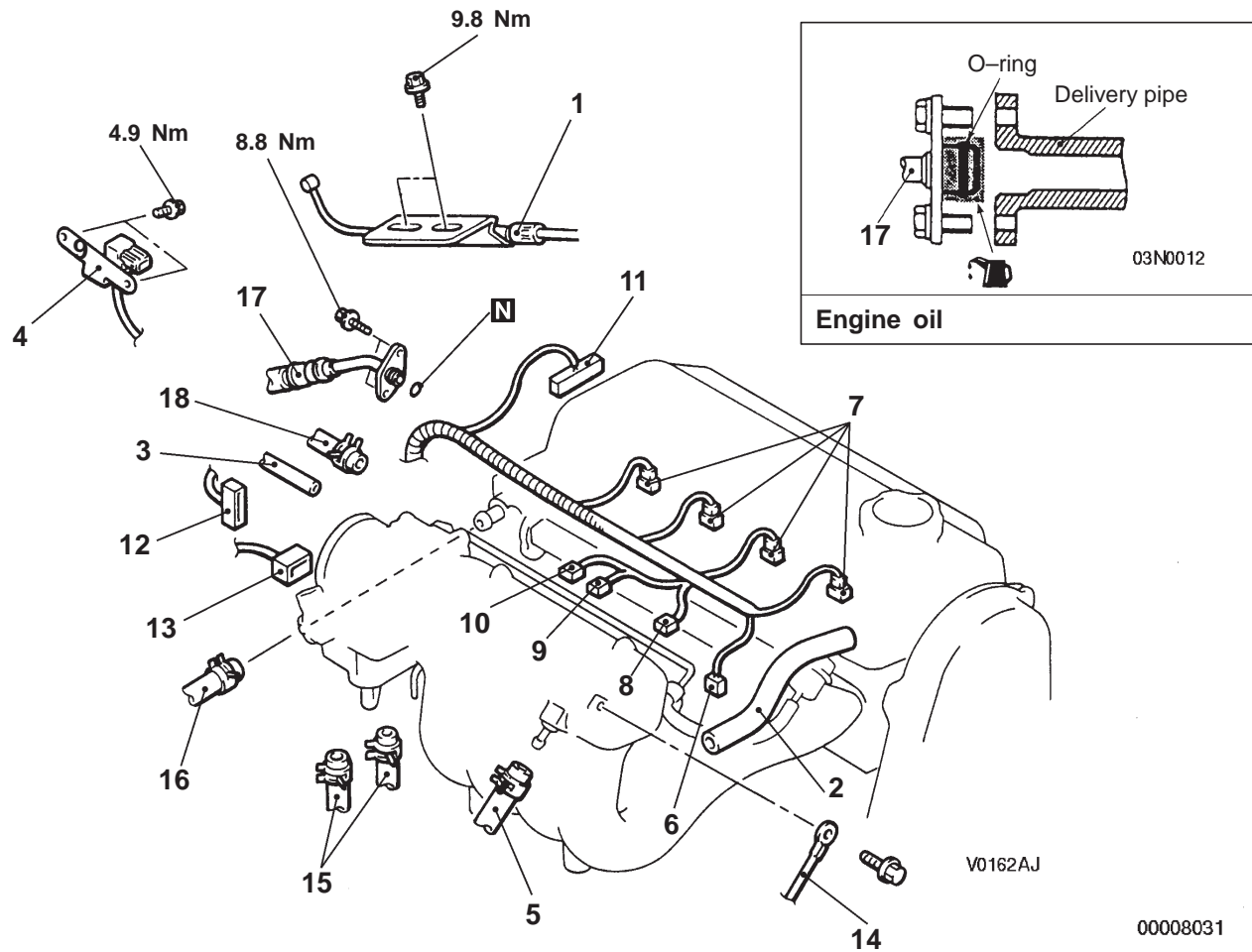
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap the oil seal unit it flushes with the oil seal case.

CYLINDER HEAD GASKET**REMOVAL AND INSTALLATION****Pre-removal Operation**

- Fuel Line Pressure Releasing
(Refer to GROUP 13B – 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.)

**Removal steps**

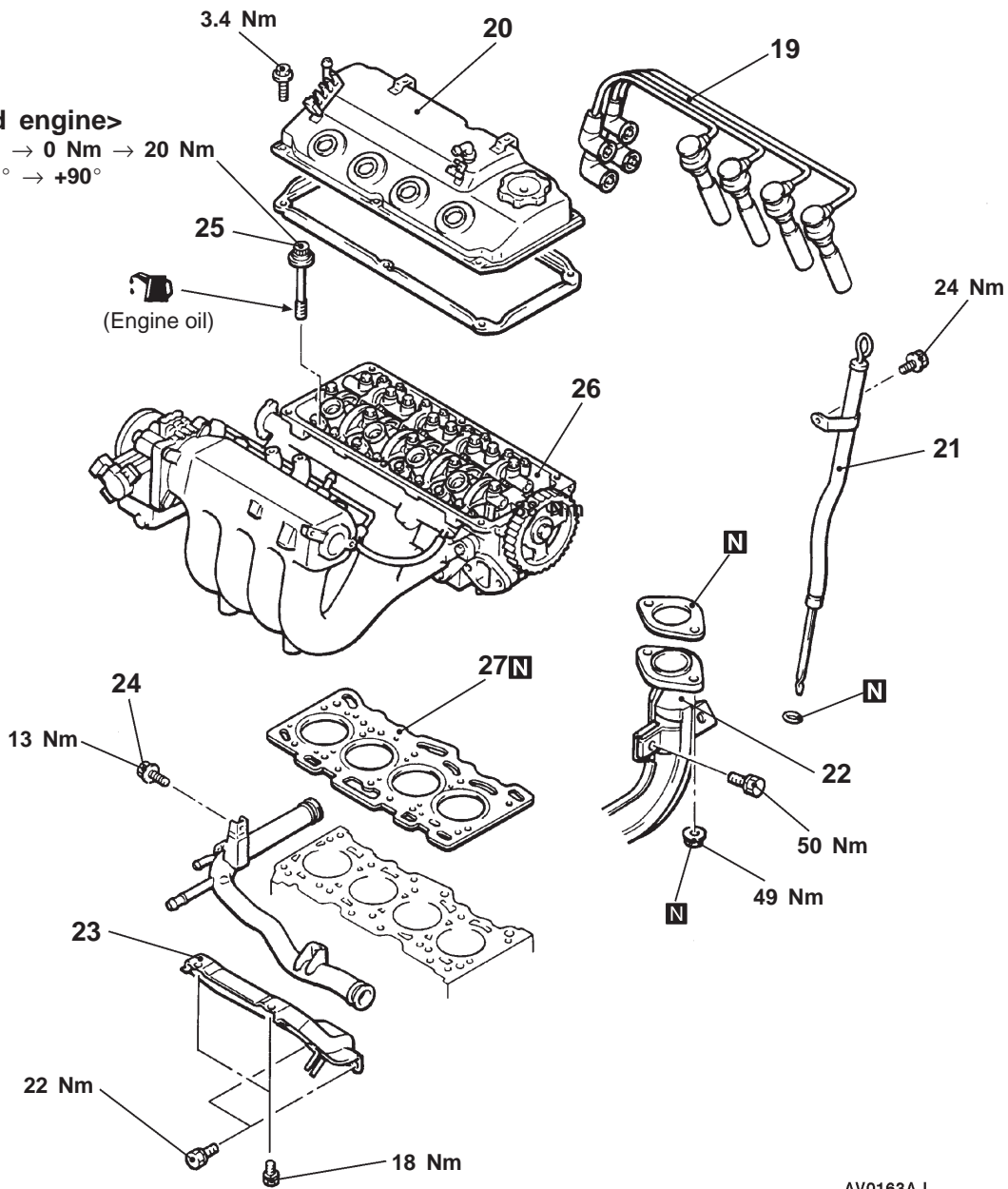
1. Accelerator cable connection
2. PCV hose
3. Vacuum hose connection
4. Boost sensor and bracket assembly
5. Brake booster vacuum hose connection
6. Detonation sensor connector
7. Injector connector
8. Intake air temperature sensor connector
9. Purge control solenoid valve connector
10. EGR solenoid valve connector
11. Distributor connector
12. Throttle position sensor connector
13. Idle speed control servo connector
14. Earth cable connection
15. Water hose connection
16. Heater hose connection
17. High-pressure fuel hose connection
18. Fuel return hose connection



<Cold engine>

49 Nm → 0 Nm → 20 Nm

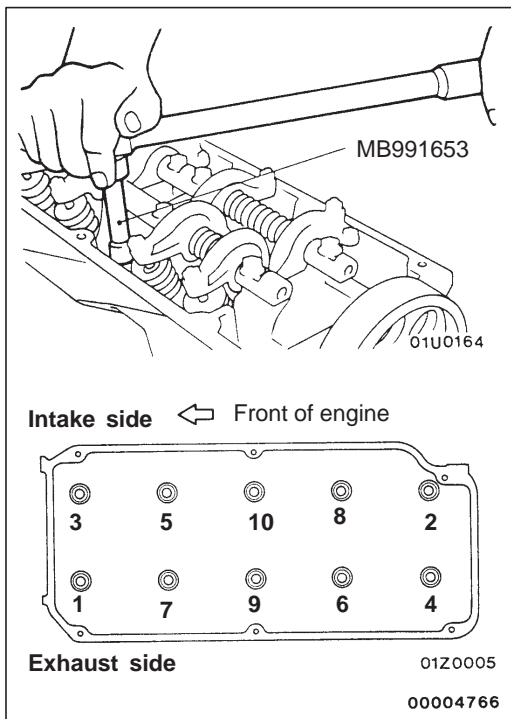
→ +90° → +90°



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- 19. Spark plug cables
- 20. Rocker cover
 - Timing belt (Refer to P.11B-25.)
- 21. Oil level gauge assembly
- 22. Front exhaust pipe connection

- 23. Intake manifold stay
- 24. Water inlet pipe connecting bolt
- 25. Cylinder head bolts
- 26. Cylinder head
- 27. Cylinder head gasket

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

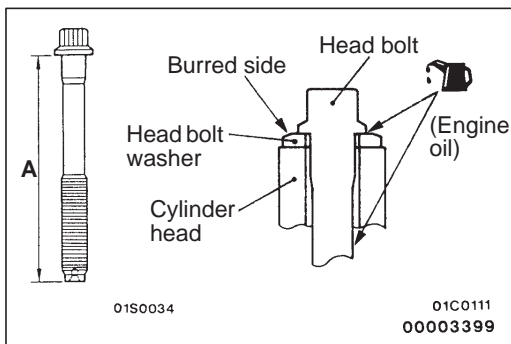
Use the special tool to loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head assembly.

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**

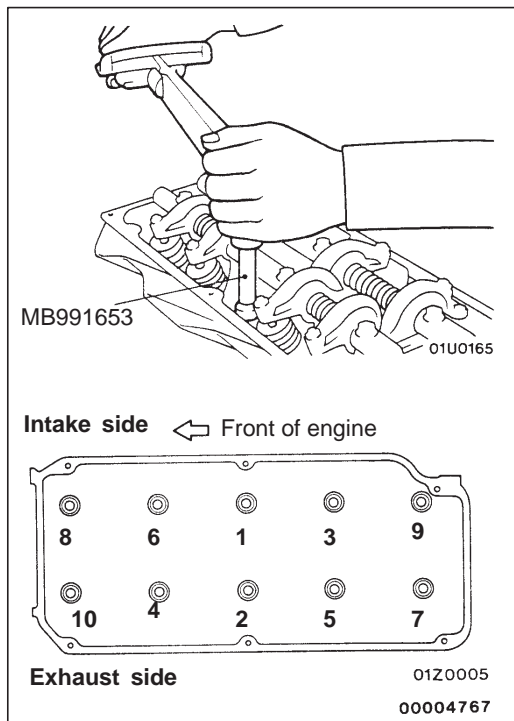
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.

**▶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): 103.2 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.

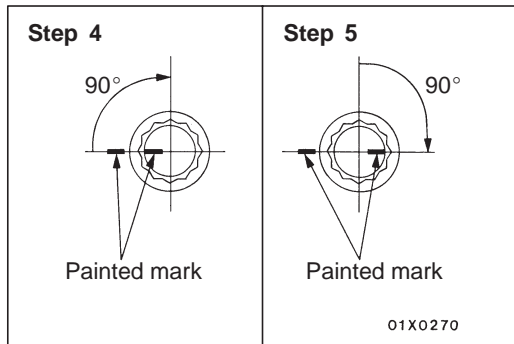


4. Use the special tool to tighten the bolts by the following procedure.

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.

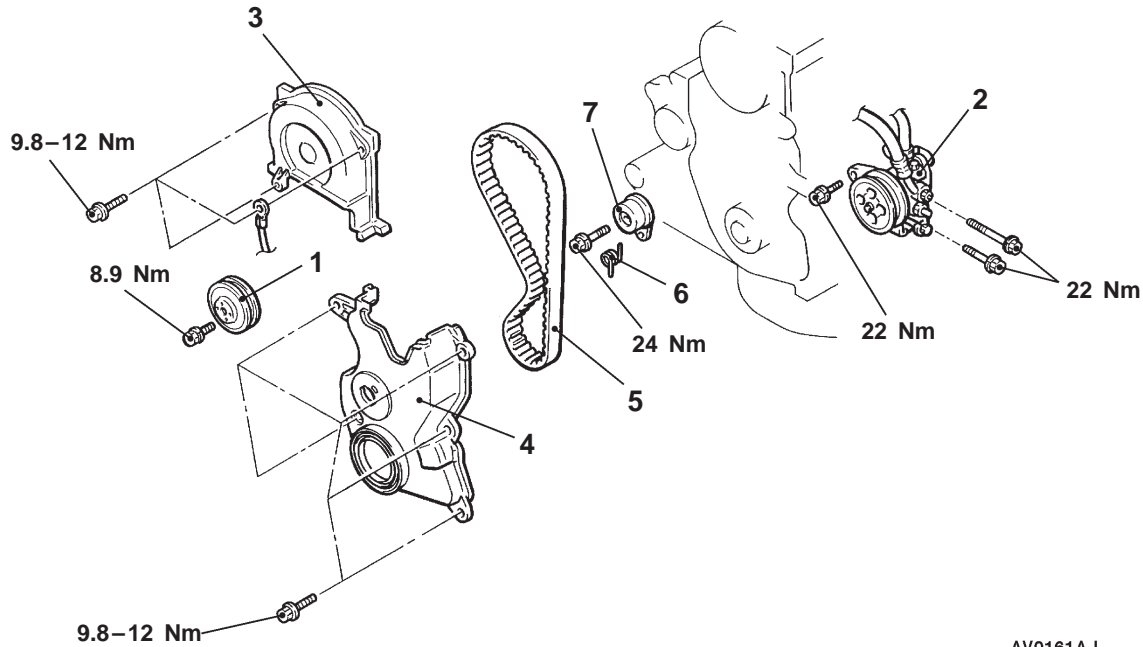
2. While turning the high-pressure fuel hose to the right and left, install the delivery pipe, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably being clamped. Disconnect the high-pressure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

- Engine Mount Bracket Removal and Installation (Refer to GROUP 32 – Engine Mounting.)
- Crankshaft Pulley Removal and Installation (Refer to P.11B-14.)



AV0161AJ

Removal steps

◀A▶

1. Water pump pulley
2. Power steering oil pump and bracket assembly
3. Timing belt upper cover
4. Timing belt lower cover

◀B▶

▶B▶
▶A▶
▶A▶
▶A▶

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

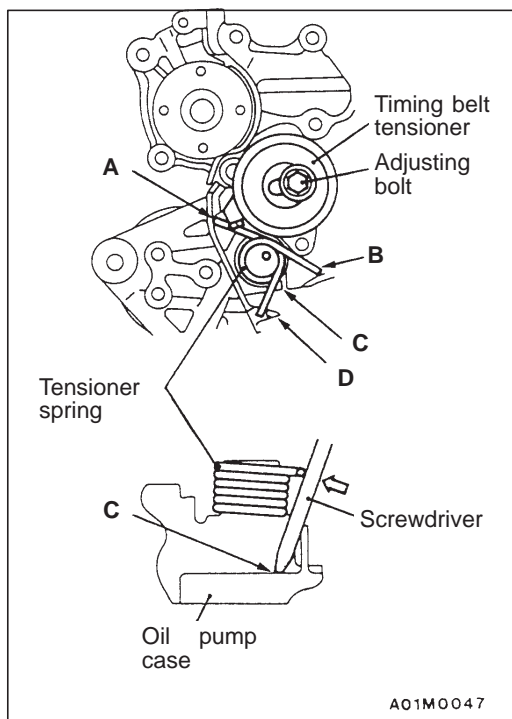
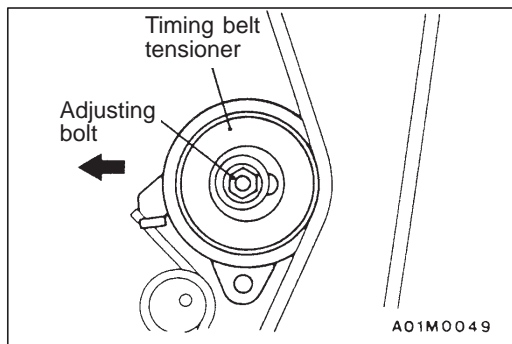
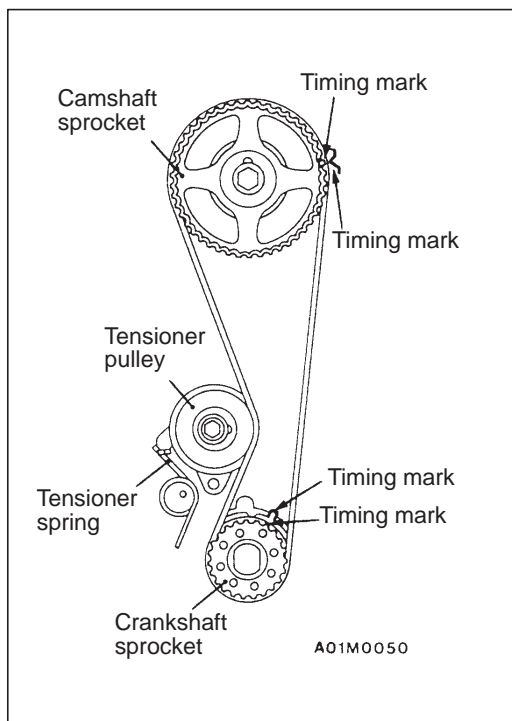
REMOVAL SERVICE POINTS

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

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

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 turn.
4. Remove the timing belt.

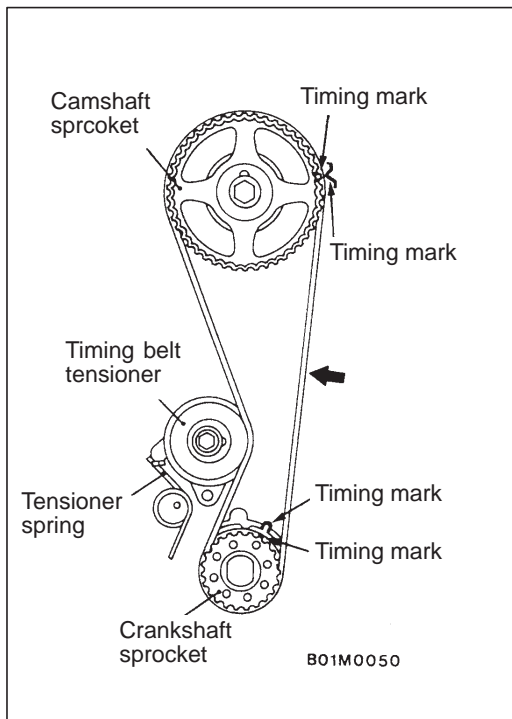
Caution

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 SPRING/TIMING BELT TENSIONER INSTALLATION

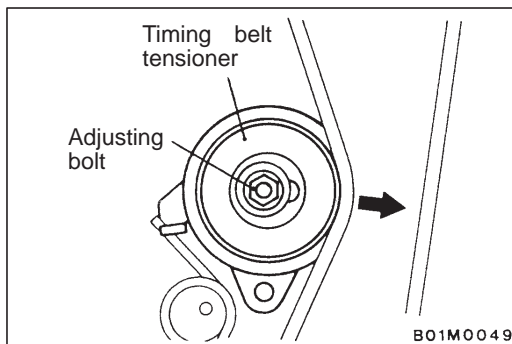
1. Put the protrusion of the timing belt tensioner on the tensioner spring end (A) as shown.
2. Move the timing belt tensioner close to the water pump, and temporarily tighten the adjusting bolt.
3. Put a screwdriver in (C), and push the protrusion (B) of the tensioner spring in the shown direction and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

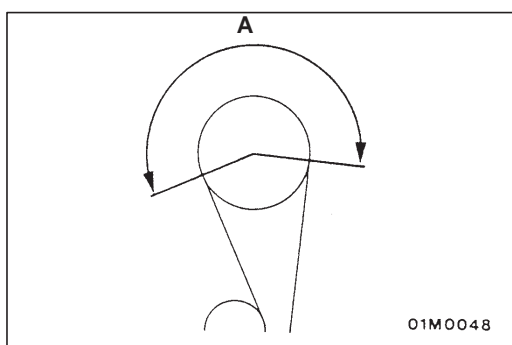
After installing the timing belt, apply force to turn the camshaft sprocket in the reverse direction, and recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.

**▶B◀TIMING BELT TENSION ADJUSTMENT**

1. Initially loosen the fixing bolt of the tensioner pulley fixed to the engine mount side by 1/2-1/4 turn, and use a 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

Caution*:

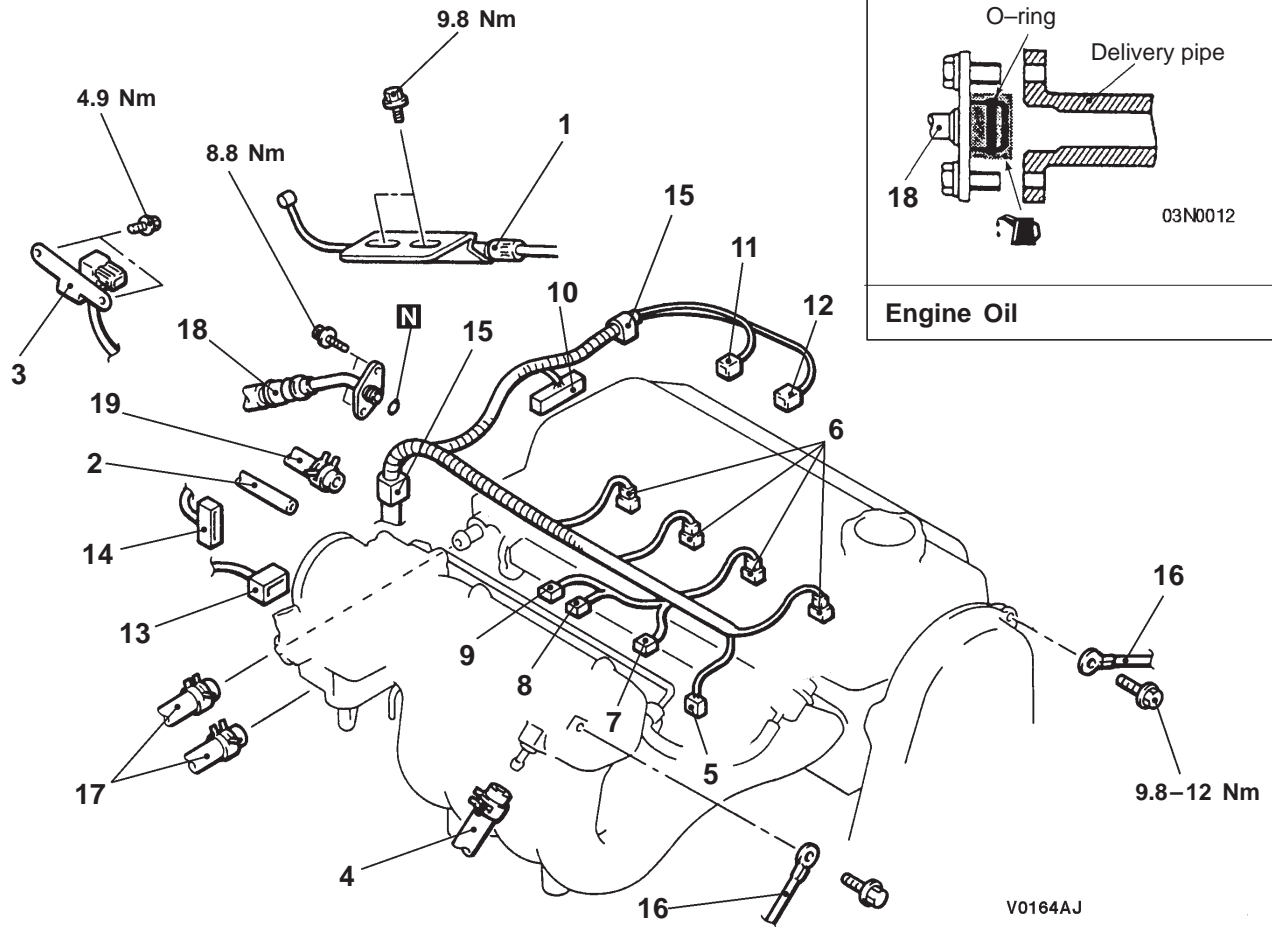
Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.

Pre-removal Operations

- Fuel Line Pressure Releasing (Refer to GROUP 13B – On-vehicle Service.)
- Hood Removal (Refer to GROUP 42.)
- Radiator Assembly Removal (Refer to GROUP 14.)
- Under Cover Panel Removal
- Air Cleaner Removal
- Front Exhaust Pipe Removal (Refer to GROUP 15.)

Post-installation Operations

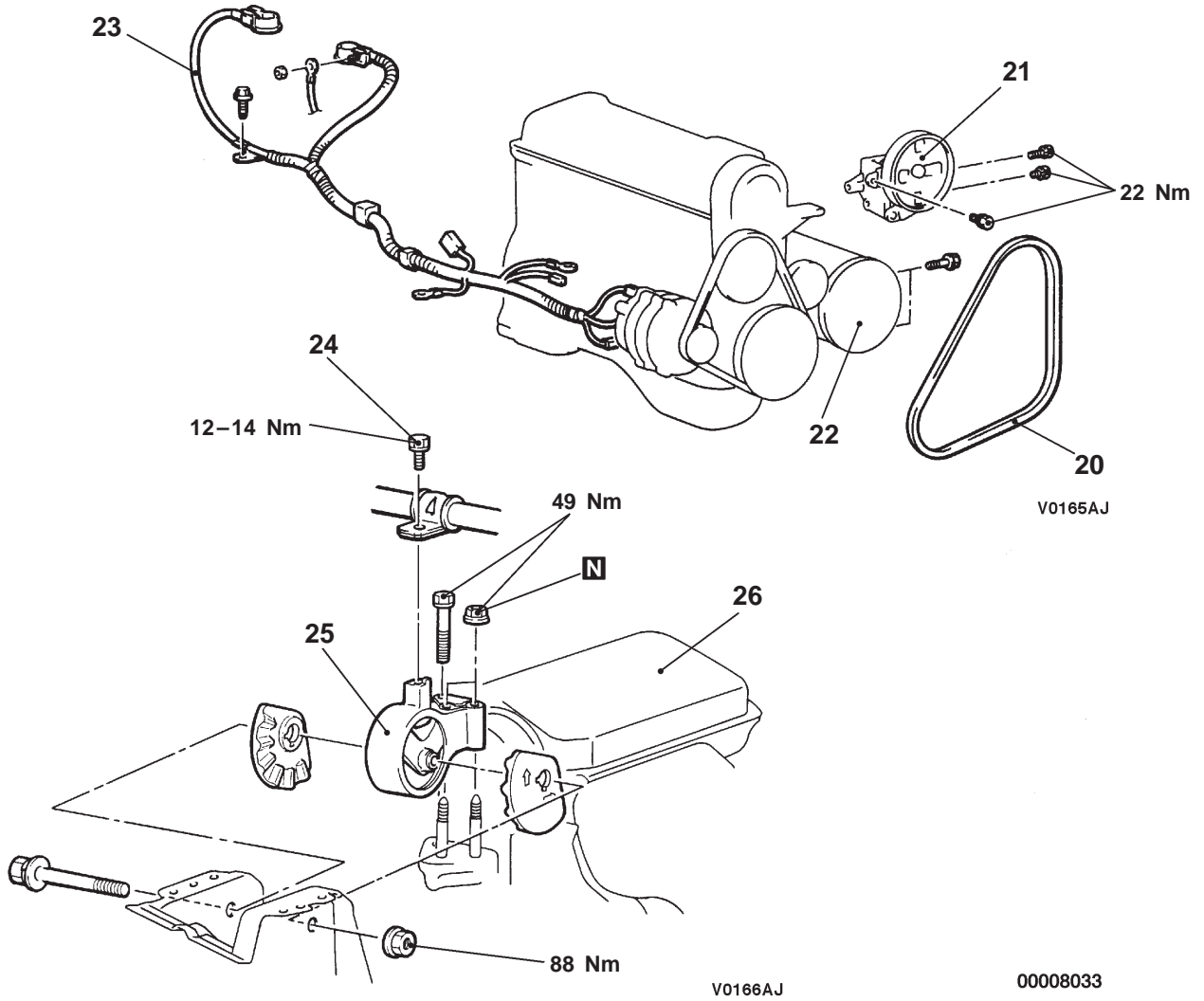
- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Radiator Assembly Installation (Refer to GROUP 14.)
- Air Cleaner Installation
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)
- Drive Belt Tension Adjustment (Refer to P.11B-5.)
- Hood Installation (Refer to GROUP 42.)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



Removal steps

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Accelerator cable connection 2. Vacuum hoses connection 3. Boost sensor and bracket assembly 4. Brake booster vacuum hose connection 5. Detonation sensor connector 6. Injector connector 7. Intake air temperature sensor connector 8. Purge control solenoid valve connector 9. EGR solenoid valve connector 10. Distributor connector | <ol style="list-style-type: none"> 11. Engine coolant temperature sensor connector 12. Engine coolant temperature gauge unit connector 13. TPS connector 14. Idle speed control servo connector 15. Control wiring harness clamp connection 16. Earth cable connection 17. Heater hoses connection 18. High-pressure fuel hose connection 19. Fuel return hose connection |
|--|--|





◀A▶

◀B▶

- 20. Drive belt (power steering, A/C)
- 21. Power steering oil pump and bracket assembly
- 22. A/C compressor
 - Transmission assembly (Refer to GROUP 22.)

◀C▶
◀D▶

▶B▶
▶A▶

- 23. Battery cable connections
- 24. Power steering hose mounting bolt
- 25. Engine mount bracket
- 26. Engine assembly

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

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

NOTE

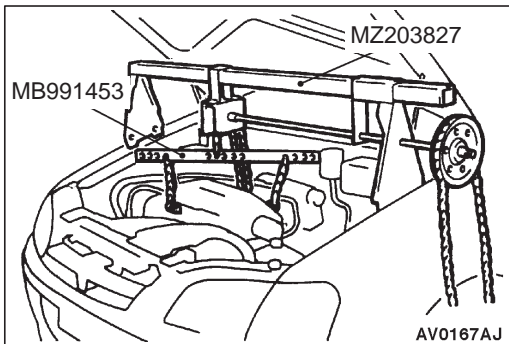
Place the removed power steering oil pump where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀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**

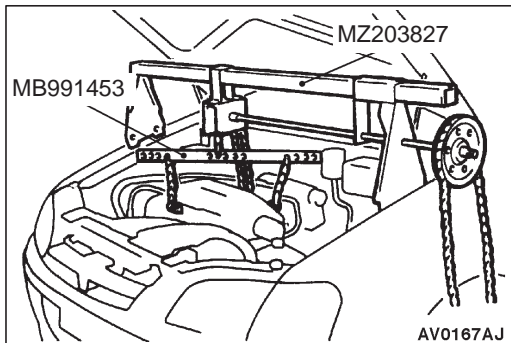
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so 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 tools.

▶C◀ FUEL HIGH PRESSURE 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 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 fuel high-pressure hose and check the O-ring for damage. After this, re-insert the delivery pipe and check that the hose turns smoothly.

NOTES

ENGINE <4G1>

CONTENTS

GENERAL	2	Ignition Timing Check and Adjustment	4
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SERVICE SPECIFICATIONS	2	CRANKSHAFT FRONT OIL SEAL	10
SEALANT	2	CYLINDER HEAD GASKET	12
SPECIAL TOOLS	3	ENGINE ASSEMBLY	15
ON-VEHICLE SERVICE	4		

GENERAL**OUTLINE OF CHANGE**

Since the catalytic converter internal-type exhaust manifold and the auto-lash adjuster are adopted, and intake manifold and the ignition system are changed, the following service adjustment procedures are made. Otherwise, the procedures are the same as that of the existing models.

GENERAL INFORMATION

Items	4G13
Auto-lash adjuster	Equipped

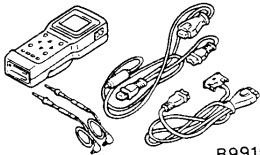
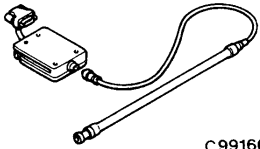
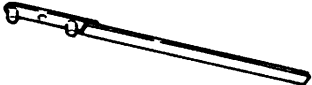
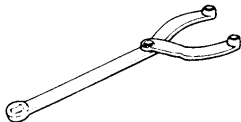
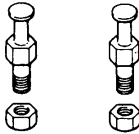
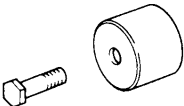
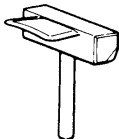
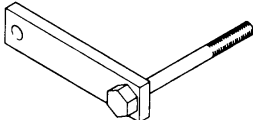
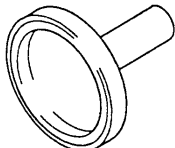
SERVICE SPECIFICATIONS

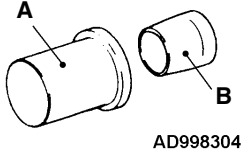
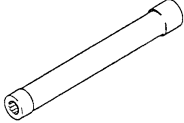
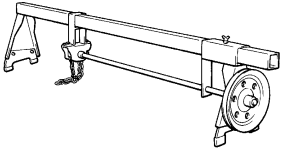

Items	Standard value	Limit
Basic ignition timing	5° BTDC ± 3°	–
Cylinder head bolt shank length mm	–	103.2

SEALANT

Items	Specified sealant	Remarks
Camshaft position sensor support	mitsubishi genuine part MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 <p>B991502</p>	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> Measuring the drive belt tension Checking the idle speed
 <p>C991668</p>	MB991668	Belt tension meter set	Measuring the drive belt tension (used together with MUT-II)
	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
	MD998727	Oil pan remover	Removing the oil pan
	MD998781	Fly wheel stopper	Securing the flywheel
	MD998718	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal

Tool	Number	Name	Use
	A: MD998304 B: MD998305	A: Crankshaft front oil seal installer B: Crankshaft front oil seal guide	Press-fitting the crankshaft front oil seal
	MB991653	Cylinder head bolt wrench	Cylinder head bolt removal and installation
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991453	Engine hanger assembly	

ON-VEHICLE SERVICE

IGNITION TIMING CHECK

1. Set the vehicle to the pre-inspection condition.
2. After turning the ignition switch to the LOCK (OFF) position, connect the MUT-II to the diagnosis connector.
3. Connect a timing light.
4. Start the engine and run it at idle.
5. Select item No. 22 on the MUT-II and take a reading of the engine speed. Check that the idle speed is at the standard value.

Standard value: 750 ± 100 r/min

6. Select item No. 17 (actuator test function) on the MUT-II, and set the ignition timing to the basic ignition timing.
7. Check the basic ignition timing.

Standard value: 5° BTDC ± 3°

8. If the basic ignition timing is outside the standard value range, check the MPI system while referring to GROUP 13B – Troubleshooting.
9. Press the CLEAR key on the MUT-II to cancel the basic ignition timing setting mode by the actuator test function.

Caution

If the mode is not cancelled, the basic ignition timing setting mode will remain active for 27 minutes, and problems with engine operation may result if the vehicle is driven during this period.

10. Check that the ignition timing is at the standard ignition timing.

Standard value: Approx. 10° BTDC

NOTE

- (1) There should be no problems if the ignition timing varies within a range of about 7°.
- (2) At high altitudes, advance the ignition timing by about a further 5° from the standard value.

LASH ADJUSTER CHECK

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

NOTE

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

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

- (2) If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.

The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.

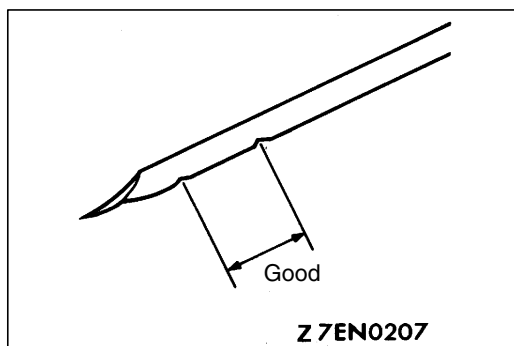
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)

3. While the engine is idling, check that the noise level does not change when the engine load is varied.
If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings. (In such cases, the lash adjusters are normal.)
4. After the engine has warmed up, run it at idle and check if any noise can be heard.
If the noise has become smaller or disappeared, oil sludge could make the lash adjusters stick. Clean the lash adjusters. (Refer to the Engine Workshop Manual.) If not improved, go to step 5.
5. Bleed air from the lash adjusters.
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters. (Refer to the Engine Workshop Manual.)

<LASH ADJUSTER AIR BLEEDING>

NOTE

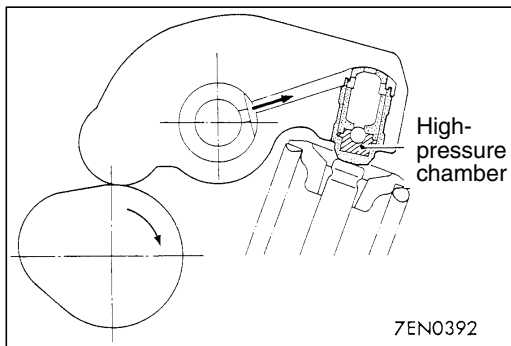
- (1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
- (2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes time for the oil to be supplied to the lash adjuster, so air can get into the high pressure chamber.
- (3) If either of the above situations occur, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.



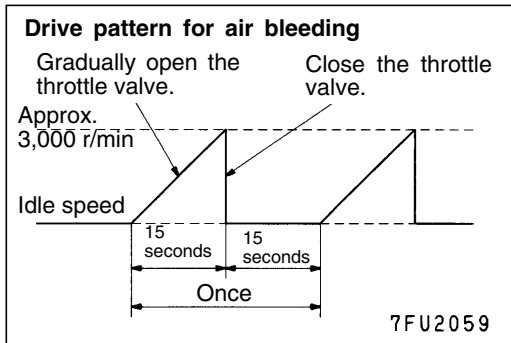
1. Check the engine oil and replenish or replace the oil if necessary.

NOTE

- (1) If there is a only small amount of oil, air will be drawn in through the oil screen and will get into the oil passage.
- (2) If the amount of oil is greater than normal, then the oil will being mixed by the crankshaft and a large amount of air may get mixed into the oil.
- (3) If the oil is degenerated, air and oil will not separate easily in oil, and the amount of air mixed into the oil will increase.



- (4) If the air which has been mixed in with the oil due to any of the above reasons gets into the high pressure chamber of the lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the lash adjuster will over-compress, resulting in abnormal noise when the valve closes. This is the same effect as if the valve clearance is adjusted to be too large by mistake. If the air inside the lash adjusters is then released, the operation of the lash adjusters will return to normal.



2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level after 30 repetitions or more, the problem is probably not due to air inside the lash adjusters.)
4. After the noise has disappeared, repeat the drive pattern shown in the illustration at left a further 5 times.
5. Run the engine at idle for 1 – 3 minutes and check that the noise has disappeared.

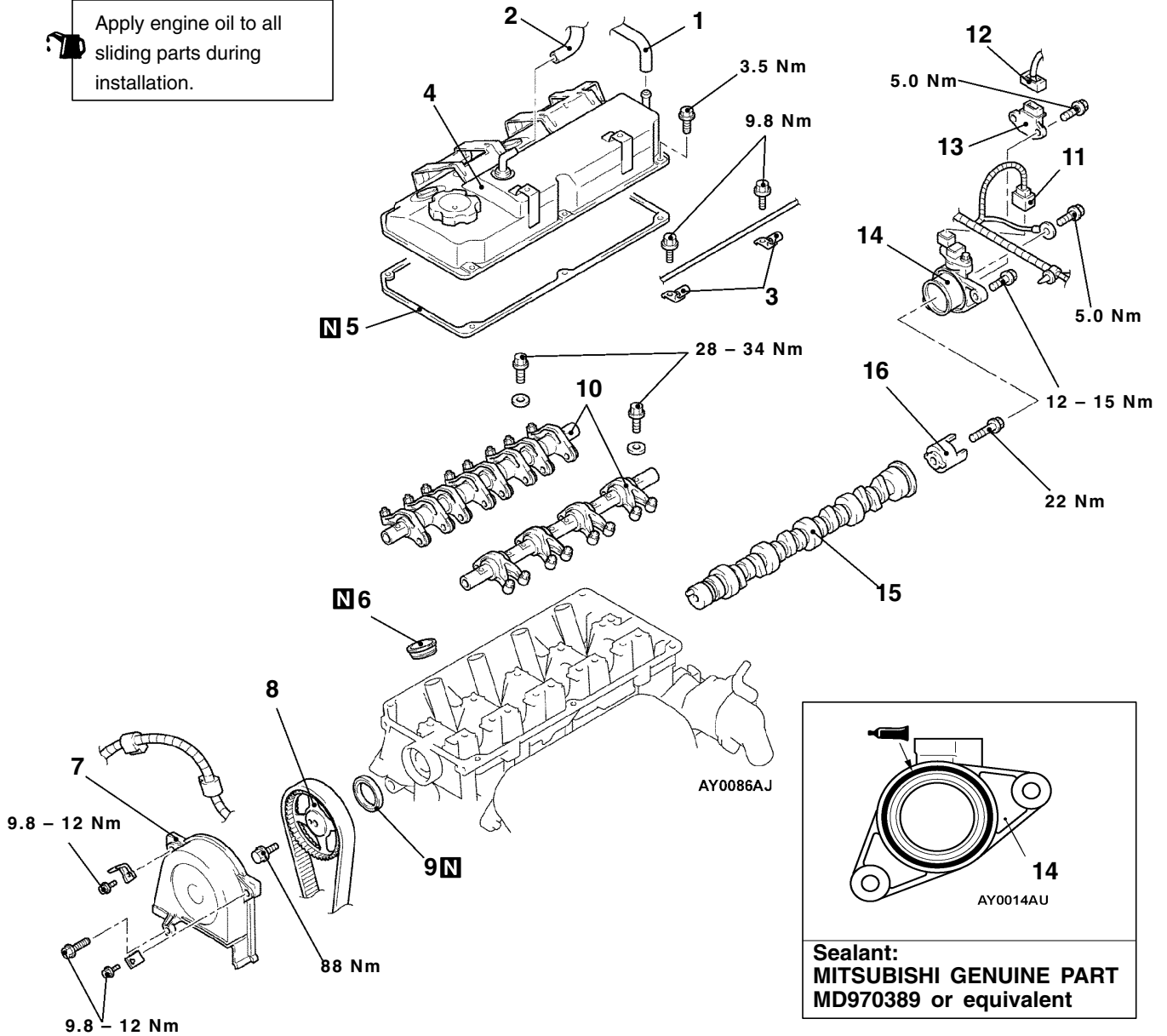
CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation
- Ignition Coil Removal and Installation (Refer to GROUP16.)

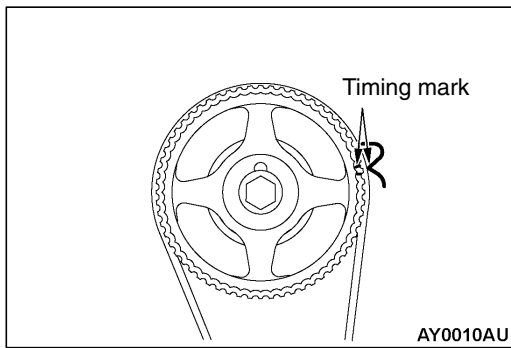
Apply engine oil to all sliding parts during installation.



Removal steps

1. Breather hose
2. PCV hose
3. Accelerator cable clamp
4. Rocker cover
5. Rocker cover gasket
6. Spark plug guide
7. Timing belt front upper cover

- | | | |
|-----|-----|--|
| ◀A▶ | ▶B▶ | 8. Camshaft sprocket |
| ▶A▶ | ▶A▶ | 9. Camshaft oil seal |
| | | 10. Rocker arm and shaft assembly |
| | | 11. Camshaft position sensor connector |
| | | 12. Ignition failure sensor connector |
| | | 13. Ignition failure sensor |
| | | 14. Camshaft position sensor support |
| | | 15. Camshaft |
| | | 16. Camshaft position sensing cylinder |



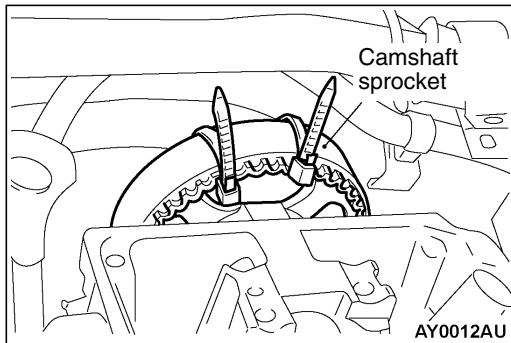
REMOVAL SERVICE POINT

◀A▶ CAMSHAFT SPROCKET REMOVAL

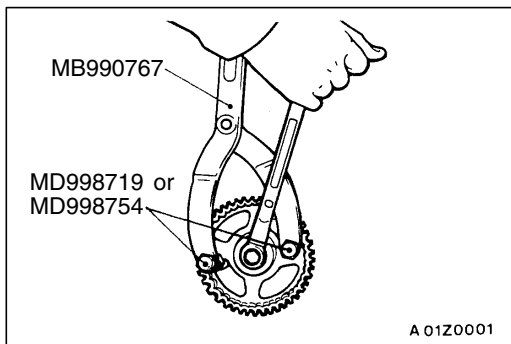
1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that No.1 cylinder is at the compression TDC.

Caution

Always turn the crankshaft in the forward direction (clockwise).



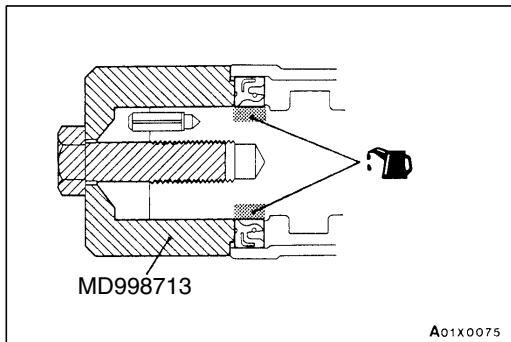
2. Secure the camshaft sprocket and the timing belt with band cablesto prevent deviation from the relative positions between the camshaft sprocket and the timing belt.



3. Use the special tool to stop the camshaft sprocket from turning.
4. Remove the camshaft sprocket with the timing belt attached.

Caution

Do not turn the crankshaft after the camshaft sprocket is removed.



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.

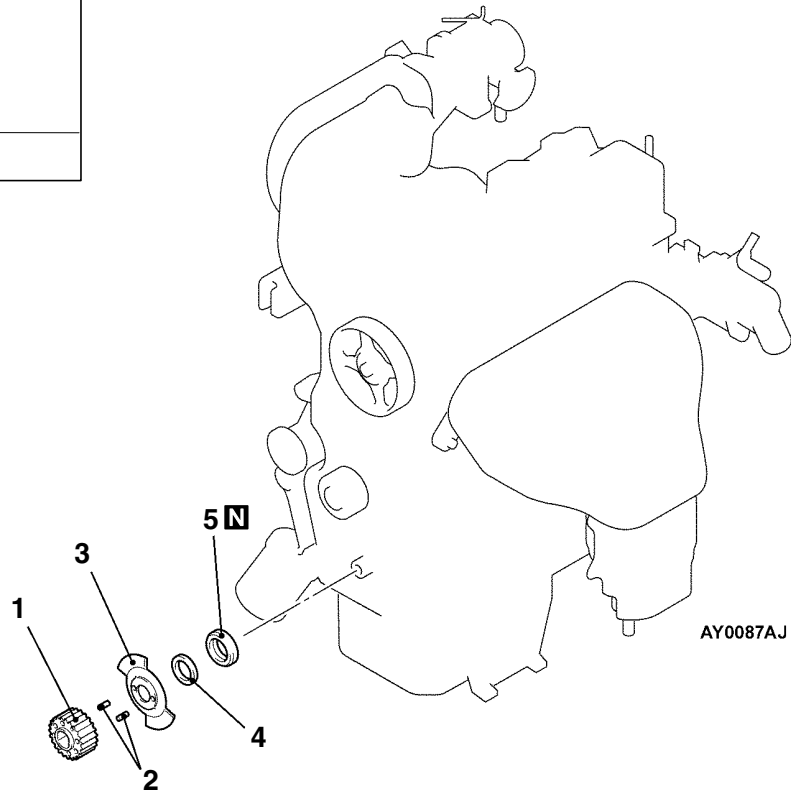
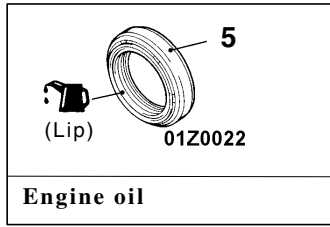
▶B◀ CAMSHAFT SPROCKET INSTALLATION

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.

Tightening torque: 88 Nm

CRANKSHAFT FRONT OIL SEAL

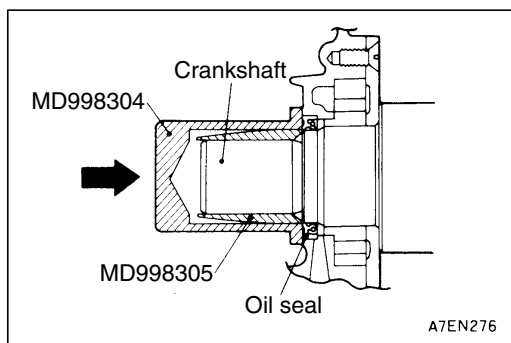
REMOVAL AND INSTALLATION



Removal steps

- Timing belt
- Crank angle sensor (Refer to GROUP 16.)

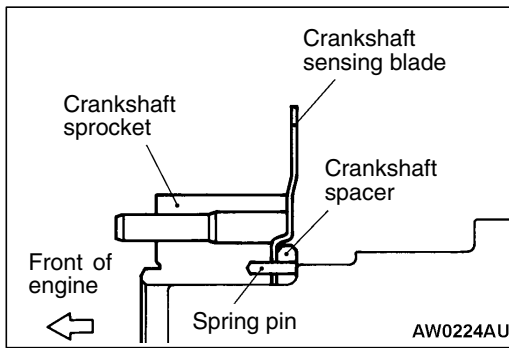
- ▶B◀ 1. Crankshaft sprocket
- ▶B◀ 2. Spring pin
- ▶B◀ 3. Crankshaft sensing blade
- ▶B◀ 4. Crankshaft spacer
- ▶A◀ 5. Crankshaft front oil seal



INSTALLATION SERVICE POINTS

▶A◀ 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 flushes with the oil seal case.



►B◄ CRANKSHAFT SPACER/CRANKSHAFT SENSING BLADE/SPRING PIN/CRANKSHAFT SPROCKET INSTALLATION

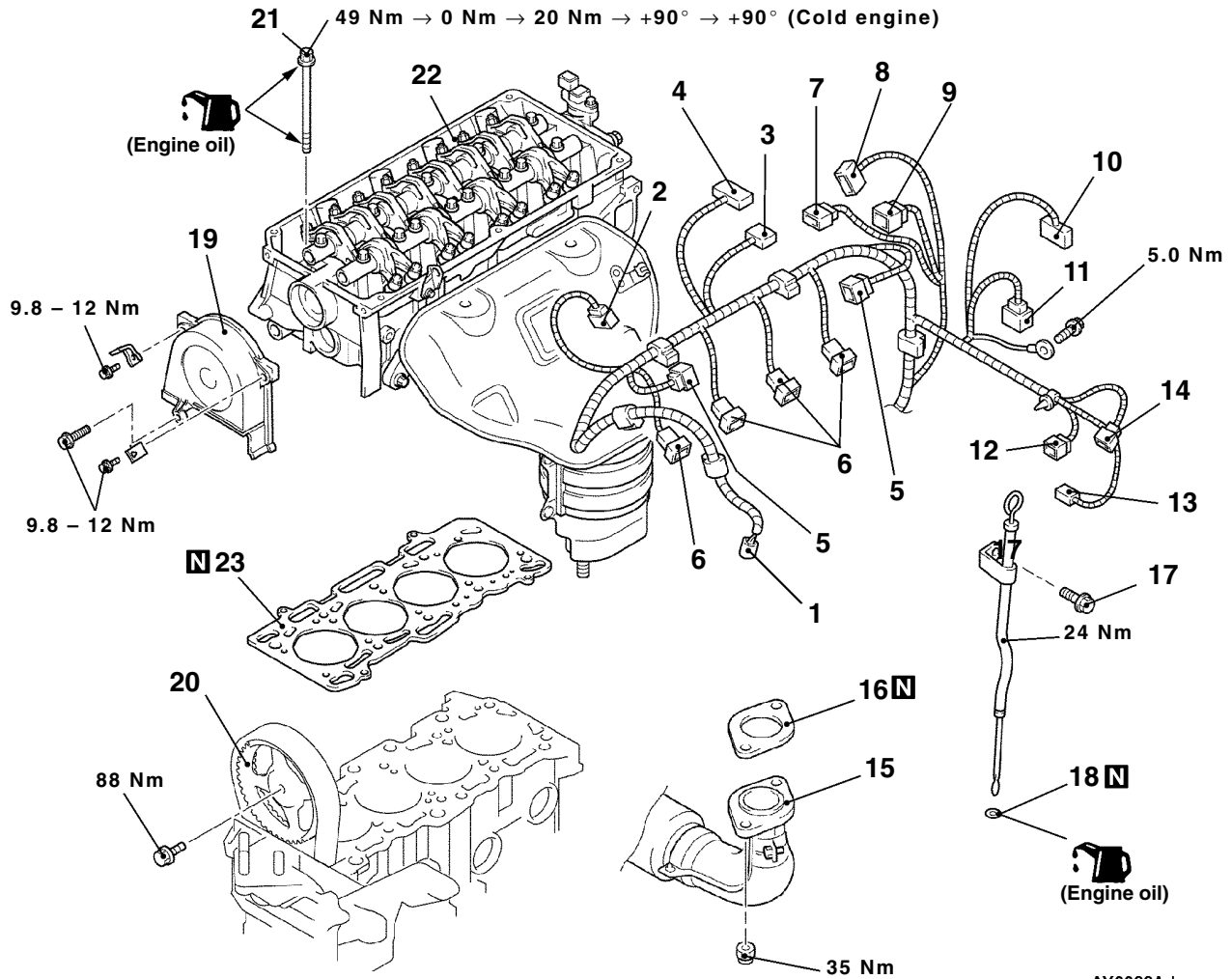
Install the crankshaft sprocket assembled with the spring pin, the crankshaft sensing blade, and the crankshaft spacer to the crankshaft.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying
- Engine Oil Draining and Supplying
- Air Cleaner Removal and Installation

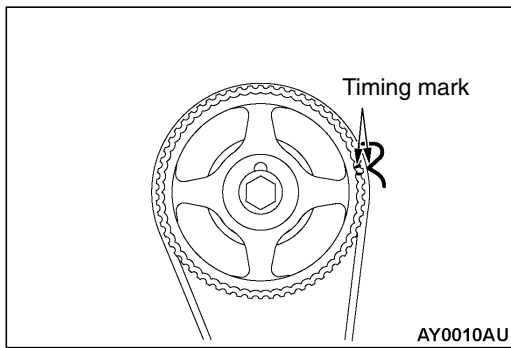


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Removal steps

- | | |
|--|---|
| <ul style="list-style-type: none"> 1. Crank angle sensor connector 2. Detonation sensor connector 3. Boost sensor connector 4. EGR solenoid valve connector 5. Ignition coil connector 6. Injector connector 7. Purge control solenoid valve connector 8. Throttle position sensor connector 9. Idle speed control servo connector 10. Ignition failure sensor connector 11. Camshaft position sensor connector 12. Engine coolant temperature sensor connector 13. Engine coolant temperature gauge unit connector | <ul style="list-style-type: none"> 14. Oxygen sensor (front) connector <ul style="list-style-type: none"> ● Rocker cover (Refer to P.11B-8.) ● Intake manifold (Refer to GROUP 15.) ● Water inlet pipe (Refer to GROUP 14.) 15. Front exhaust pipe connection 16. Front exhaust pipe gasket 17. Oil level gauge assembly 18. O-ring 19. Timing belt front upper cover 20. Camshaft sprocket 21. Cylinder head bolts 22. Cylinder head assembly 23. Cylinder head gasket |
|--|---|





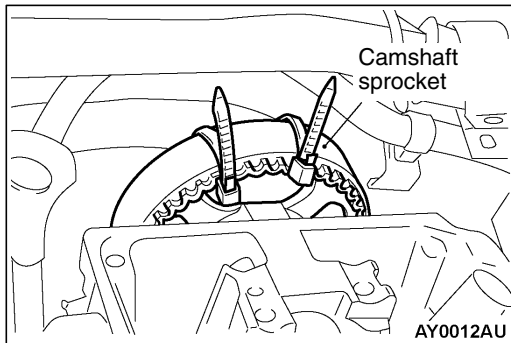
REMOVAL SERVICE POINT

◀A▶ CAMSHAFT SPROCKET REMOVAL

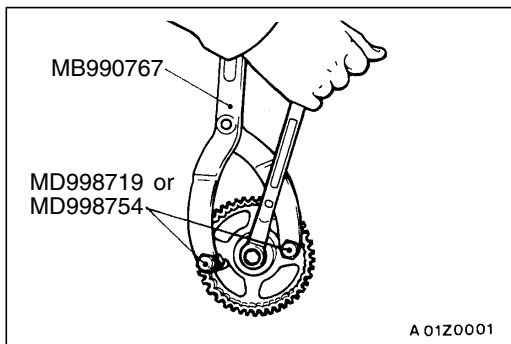
1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that No.1 cylinder is at the compression TDC.

Caution

Always turn the crankshaft in the forward direction (clockwise).



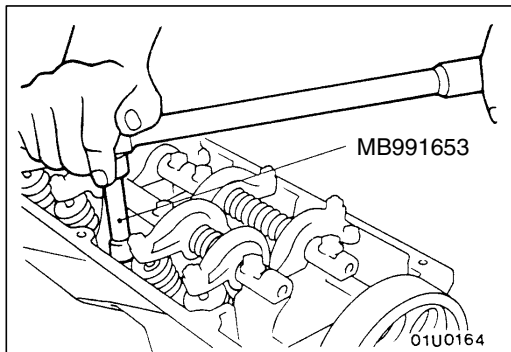
2. Secure the camshaft sprocket and the timing belt with band cablesto prevent deviation from the relative positions between the camshaft sprocket and the timing belt.



3. Use the special tool to stop the camshaft sprocket from turning.
4. Remove the camshaft sprocket with the timing belt attached.

Caution

Do not turn the crankshaft after the camshaft sprocket is removed.



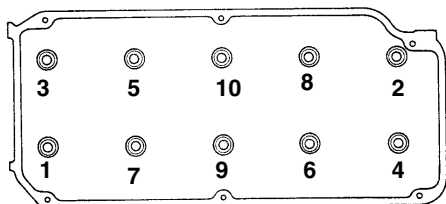
◀B▶ CYLINDER HEAD BOLT REMOVAL

Use the special tool to 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.

Intake side ← Front of engine



Exhaust side

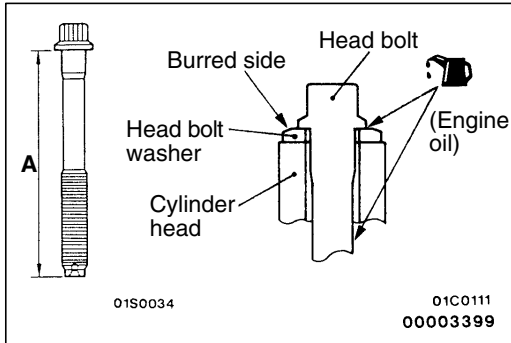
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INSTALLATION SERVICE POINTS

▶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.

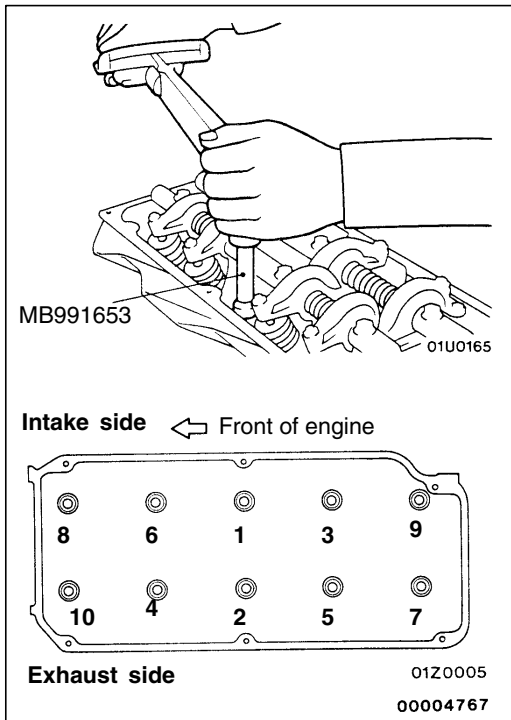


▶B◀ CYLINDER HEAD BOLT INSTALLATION

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. Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.
4. Use the special tool to 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.

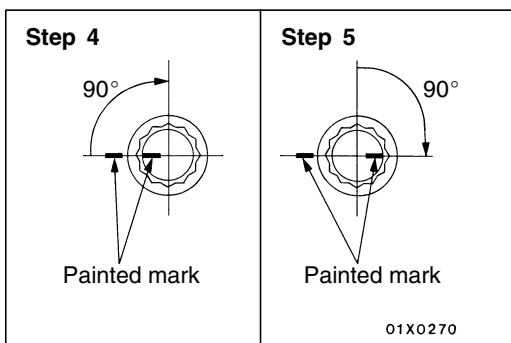
Caution

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◀ 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.

Tightening torque: 88 Nm

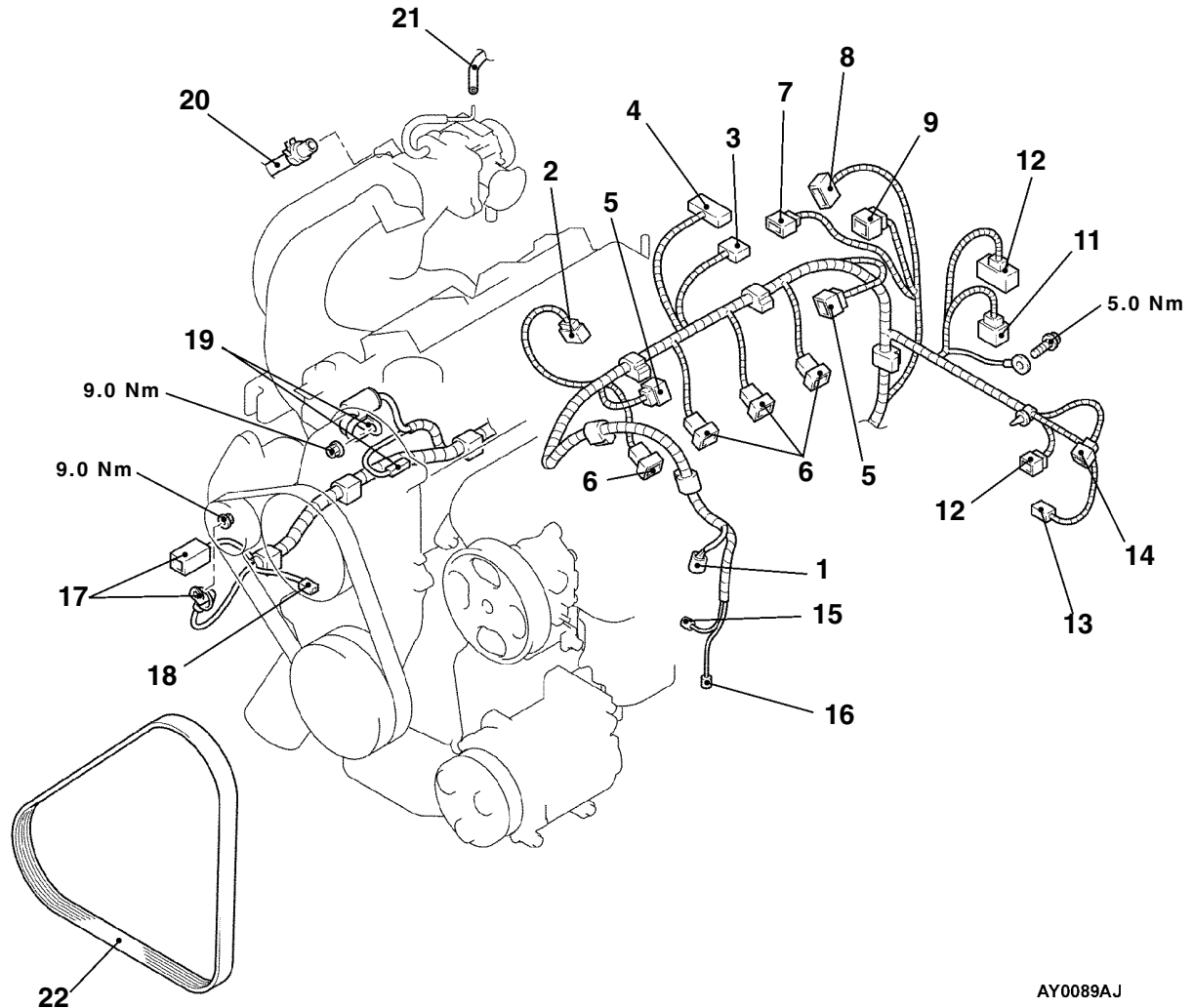


ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- Accelerator Cable Adjustment
(Refer to GROUP 17 – On-vehicle Service.)
- Drive Belt Tension Adjustment
- Under Cover Removal and Installation
- Air Cleaner Removal and Installation
- Hood Removal and Installation
- Radiator Assembly Removal (Refer to GROUP 14.)



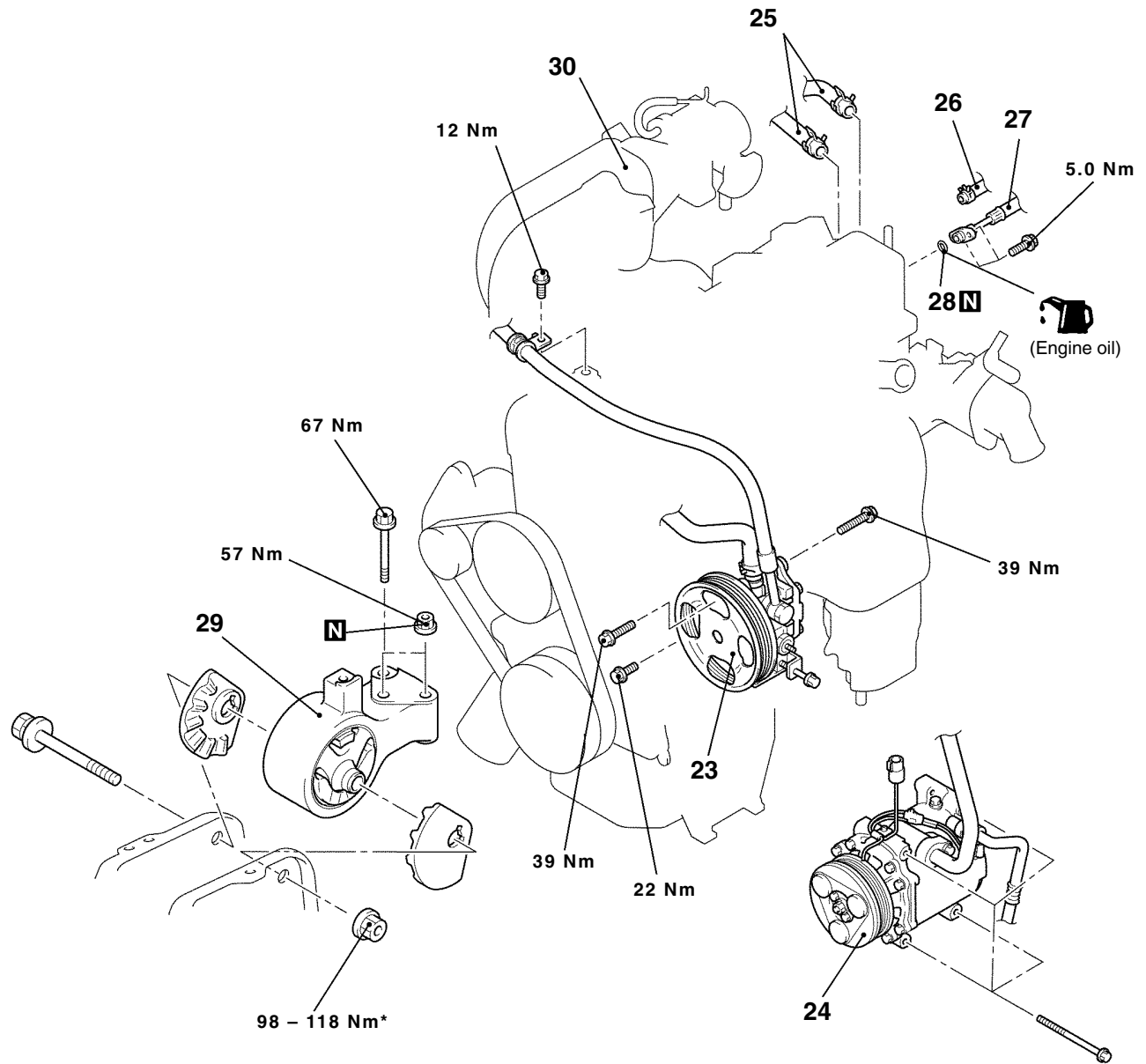
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Removal steps

1. Crank angle sensor connector
2. Detonation sensor connector
3. Boost sensor connector
4. EGR solenoid valve connector
5. Ignition coil connector
6. Injector connector
7. Purge control solenoid valve connector
8. Throttle position sensor connector
9. Idle speed control servo connector
10. Ignition failure sensor connector
11. Camshaft position sensor connector
12. Engine coolant temperature sensor connector
13. Engine coolant temperature gauge unit connector
14. Oxygen sensor (front) connector
15. Power steering oil pressure switch connector
16. A/C compressor connector
17. Alternator connector
18. Oil pressure switch connector
19. Starter connector
20. Brake booster vacuum hose connection
21. Vacuum hose connection
22. Drive belt (Power steering and A/C)

Caution

*: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.



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23. Power steering oil pump and bracket assembly



24. A/C compressor
 25. Heater hoses connection
 26. Fuel return hose connection



27. High-pressure fuel hose connection



28. O-ring

● Transmission assembly



29. Engine mount Bracket



30. Engine assembly

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

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

NOTE

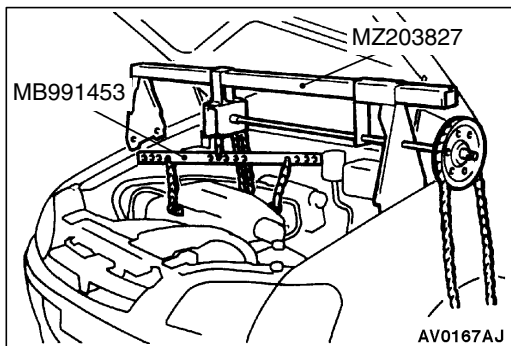
Place the removed power steering oil pump where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀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**

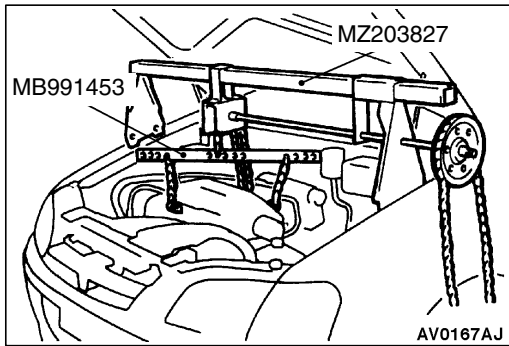
1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so 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 tools.

►C◄ FUEL HIGH PRESSURE 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 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 fuel high-pressure hose and check the O-ring for damage. After this, re-insert the delivery pipe and check that the hose turns smoothly.
4. Tighten to the specified torque.

Tightening torque: 5.0 Nm

ENGINE <4G1>

CONTENTS

GENERAL	2	ON-VEHICLE SERVICE	3
Outline of Change	2	Ignition Timing Check	3
GENERAL INFORMATION	2	Compression Pressure Check	3
SERVICE SPECIFICATIONS	2	CRANKSHAFT FRONT OIL SEAL	
		<4G18-A/T>	4

11B-2 ENGINE <4G1> – General/General Information/Service Specifications

GENERAL

OUTLINE OF CHANGE

Due to the addition of the 4G18 engine models, some service procedures have been added. The other service procedures are the same as before.

GENERAL INFORMATION

Items		4G18	
Total displacement mL		1,584	
Bore × Stroke mm		76 × 87.3	
Compression ratio		10.0	
Combustion chamber		Pentroof type	
Camshaft arrangement		SOHC	
Number of valve	Intake	8	
	Exhaust	8	
Valve timing	Intake	Opening	BTDC 9°
		Closing	ABDC 51°
	Exhaust	Opening	BBDC 45°
		Closing	ATDC 15°
Fuel system		Electronic control multipoint fuel injection	
Rocker arm		Roller type	
Auto-lash adjuster		Equipped	

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Idle speed r/min	4G18 <A/T>	750 ± 100	–
Compression pressure (250 – 400 r/min) kPa		1,697	Min. 1,226
Compression pressure difference of all cylinders kPa		–	Max. 100

ON-VEHICLE SERVICE

IGNITION TIMING CHECK

The idle speed has been changed. The other items are the same as before.

Standard value: 750 ± 100 r/min <A/T>

COMPRESSION PRESSURE CHECK

The compression pressure has been revised. The other items are the same as before.

Compression pressure (250 – 400 r/min)

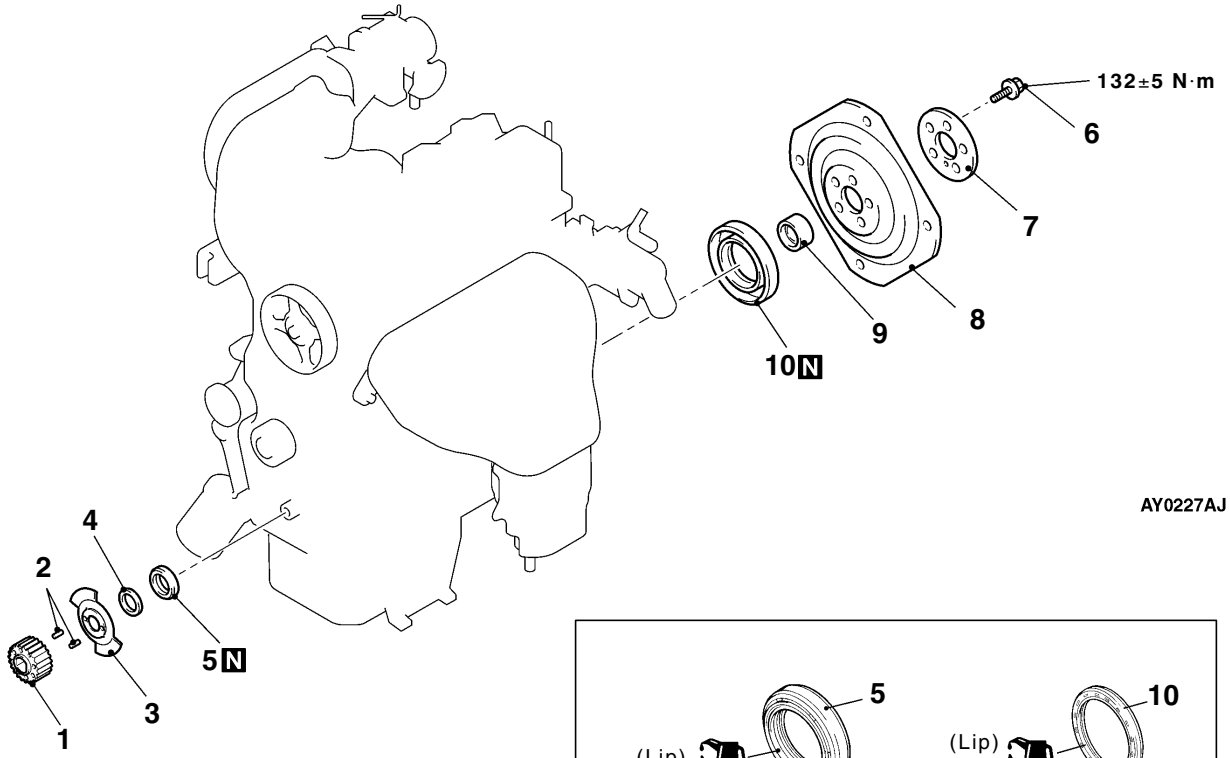
Standard value (at engine speed of 250 – 400 r/min):
1,697 kPa <4G18>

Limit (at engine speed of 250 – 400 r/min):
Min. 1,226 kPa <4G18>

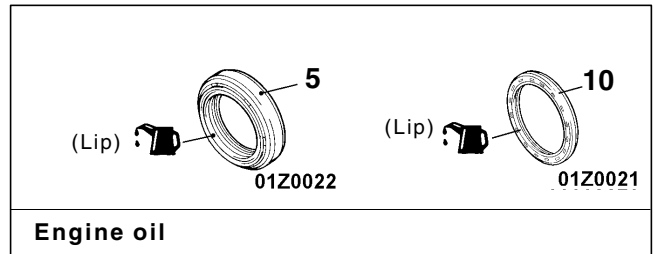
Compression pressure difference of all cylinders
Limit: Max. 100 kPa <4G18>

CRANKSHAFT FRONT OIL SEAL<4G18-A/T>

REMOVAL AND INSTALLATION



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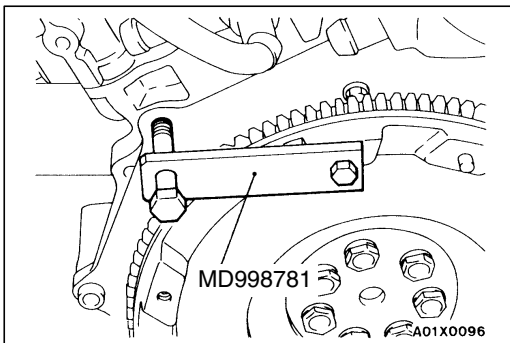
Crankshaft front oil seal removal steps

- Timing belt
- Crank angle sensor
- ▶▶B▶▶ 1. Crankshaft sprocket
- ▶▶B▶▶ 2. Spring pin
- ▶▶B▶▶ 3. Crankshaft sensing blade
- ▶▶B▶▶ 4. Crankshaft spacer
- ▶▶A▶▶ 5. Crankshaft front oil seal



Crankshaft rear oil seal removal steps

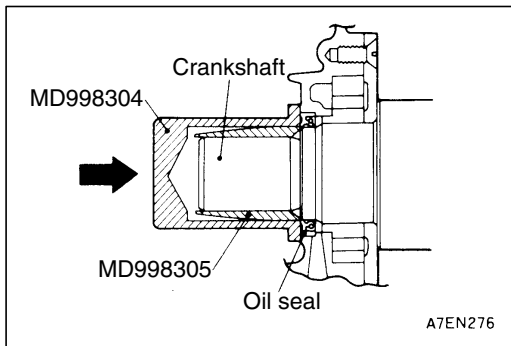
- Transmission assembly
- 6. Drive plate bolts
- 7. Adapter plate
- 8. Drive plate
- 9. Crankshaft bushing
- 10. Crankshaft rear oil seal



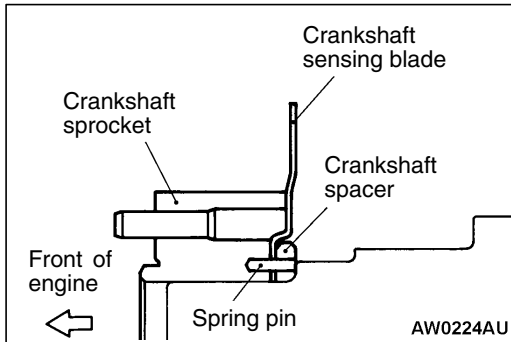
REMOVAL SERVICE POINT

▶▶A▶▶ DRIVE PLATE BOLTS REMOVAL

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

**INSTALLATION SERVICE POINTS****▶A◀ 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 flushes with the oil seal case.

**▶B◀ CRANKSHAFT SPACER/CRANKSHAFT SENSING BLADE/SPRING PIN/CRANKSHAFT SPROCKET INSTALLATION**


Install the crankshaft sprocket assembled with the spring pin, the crankshaft sensing blade, and the crankshaft spacer to the crankshaft.

NOTES



SERVICE BULLETIN

PUBLICATION GROUP, AFTER SALES SERVICE DEP.
MITSUBISHI MOTOR SALES EUROPE BV

SERVICE BULLETIN		No.: ESB-99E11-501	
		Date: 1999-07-15	<Model> <M/Y>
Subject:	CORRECTION OF VALUE OF VALVE CLEARANCE	(EC) SPACE STAR (DG1A, DG5A)	99-10
Group:	ENGINE		
INFORMATION		 O. Kai - E.V.P. & G.M. After Sales Service Dept.	
1. Description:			
This service bulletin informs you of correction of valve clearance value.			
2. Applicable Manuals:			
	Manual	Pub. No.	Language
	'99 SPACE STAR Workshop Manual Chassis	CMXE99E1	(English)
		CMXS99E1	(Spanish)
		CMXF99E1	(French)
		CMXG99E1	(German)
		CMXD99E1	(Dutch)
		CMXW99E1	(Swedish)
		CMXI99E1	(Italian)
			11B-3
3. Details:			
Refer to the attached sheet.			

Items			Standard value	Limit
Power steering oil pump and A/C compressor drive belt tension	Vibration frequency Hz	When checked	137-168	-
		When a used belt is installed	145-160	-
		When a new belt is installed	174-199	-
	Tension N	When checked	392-588	-
		When a used belt is installed	441-539	-
		When a new belt is installed	637-834	-
	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	<Incorrect> 0.20 ← 0.25 <Correct>	-	
	Exhaust valve	0.30		
Basic ignition timing			5° BTDC ± 2°	-
Ignition timing			Approx. 10° BTDC	-
Idle speed r/min			750 ± 100	-
CO contents %			0.5 or less	-
HC contents ppm			100 or less	-
Compression pressure (250-400 r/min) kPa			1,598	Min. 1,161
Compression pressure difference of all cylinder kPa			-	Max. 100
Intake manifold vacuum kPa				Min. 60
Cylinder head bolt shank length mm			-	103.2

SEALANT


1100050218

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



SERVICE BULLETIN

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN		No.: MSB-00E11-504	
		Date: 2001-09-05	<Model> <M/Y>
Subject: CORRECTION TO CAMSHAFT & CAMSHAFT OIL SEAL REMOVAL & INSTALLATION PROCEDURE		(EC) COLT(CK0A, CJ 0A) (EC)SPACE STAR(DG0A)	01-10 01-10
Group: ENGINE	Draft No.: 00AL083008		
CORRECTION	INTERNATIONAL CAR ADMINISTRATION OFFICE	 T.MASAKI-MANAGER TECHNICAL SERVICE PLANNING	

1. Description:

On the 4G13 engine equipped car, corrections have been made to the removal and installation procedure for the camshaft and camshaft oil seal.

2. Applicable Manuals:


Manual	Pub. No.	Language	Page(s)
2001 COLT Workshop Manual chassis	PWME9511-C	(English)	11A-8, 9, 10
	PWMS9512-C	(Spanish)	
	PWMF9513-C	(French)	
	PWMG9514-C	(German)	
	PWMD9515-C	(Dutch)	
	PWMW9516-C	(Swedish)	
2001 COLT Workshop Manual CD-ROM	PWMK0019R	(English)	
	PWMK0019R	(Spanish)	
	PWMK0019R	(French)	
	PWMK0019R	(German)	
	PWMK0019R	(Dutch)	
	PWMK0019R	(Swedish)	
2001 SPACE STAR Workshop Manual chassis	CMXE99E1-A	(English)	11B-8, 9
	CMXS99E1-A	(Spanish)	
	CMXF99E1-A	(French)	
	CMXG99E1-A	(German)	
	CMXD99E1-A	(Dutch)	
	CMXW99E1-A	(Swedish)	

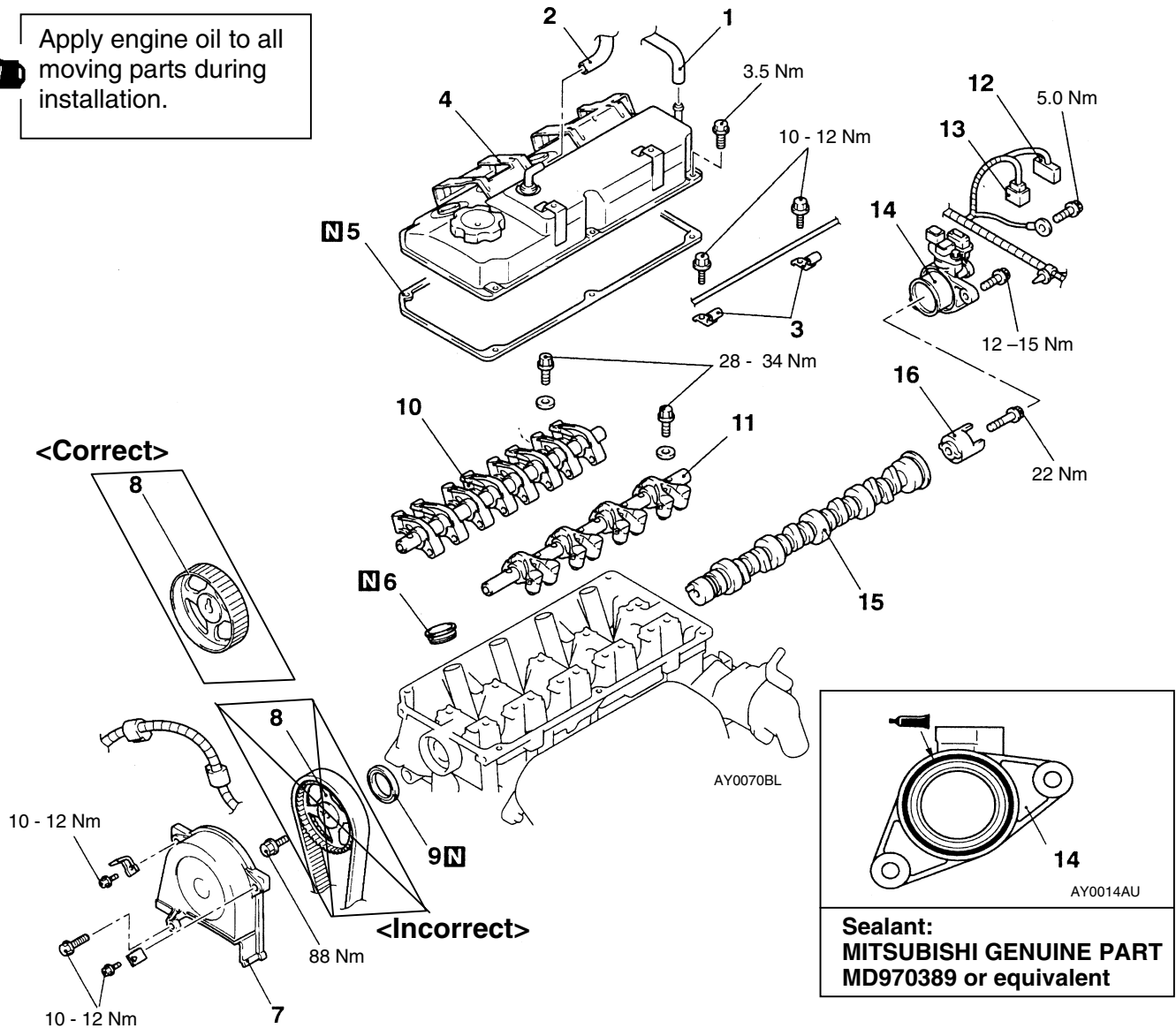
CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation
- Ignition Coil Removal and Installation (Refer to GROUP 16.)

 Apply engine oil to all moving parts during installation.

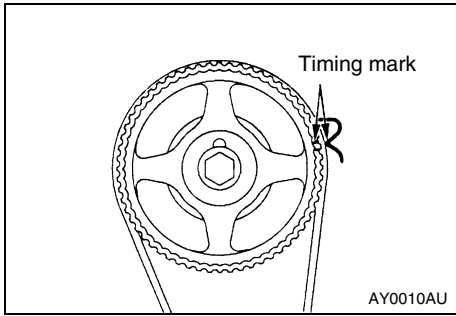


Removal steps

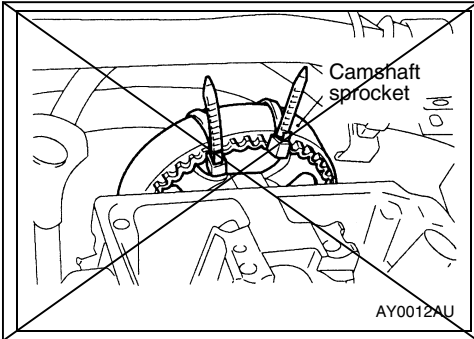
1. Breather hose connection
2. PCV hose connection
3. Accelerator cable clamp <LH drive vehicles>
4. Rocker cover
5. Rocker cover gasket
6. Spark plug guide
7. Timing belt front upper cover
8. Camshaft sprocket
9. Camshaft oil seal

10. Lash adjuster, intake rocker arm and shaft assembly
11. Lash adjuster, exhaust rocker arm and shaft assembly
12. Ignition failure sensor connector
13. Camshaft position sensor connector
14. Camshaft position sensor support
15. Camshaft
16. Camshaft position sensing cylinder





<Incorrect>



<Incorrect>

REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that No. 1 cylinder is at the compression TDC.

Caution

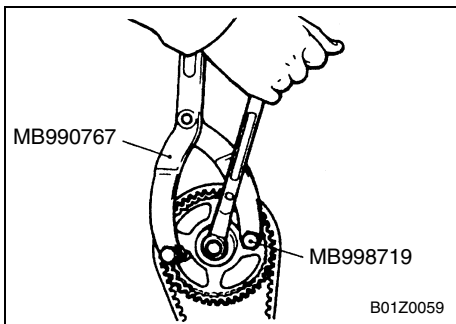
Always turn the crankshaft in the forward direction (clockwise).

2. ~~Secure the camshaft sprocket and the timing belt with band cables to prevent deviation from the relative positions between the camshaft sprocket and the timing belt.~~

<Correct>

Put matchmarks on the camshaft sprocket and the timing belt.

“A” on next page comes here.

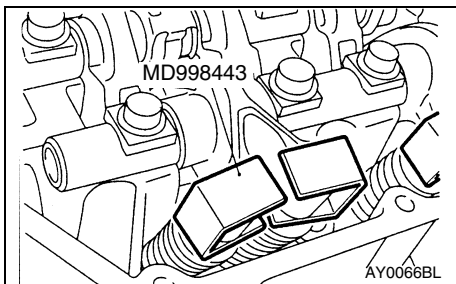


3. Use the special tool to stop the camshaft sprocket from turning.
4. Remove the camshaft sprocket ~~with the timing belt attached.~~

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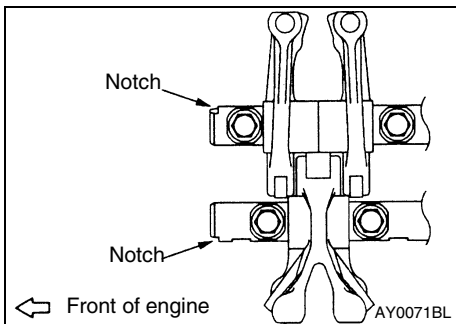
Caution

Do not turn the crankshaft after the camshaft sprocket is removed.



◀B▶ LASH ADJUSTER, INTAKE ROCKER ARM AND SHAFT ASSEMBLY/LASH ADJUSTER, EXHAUST ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

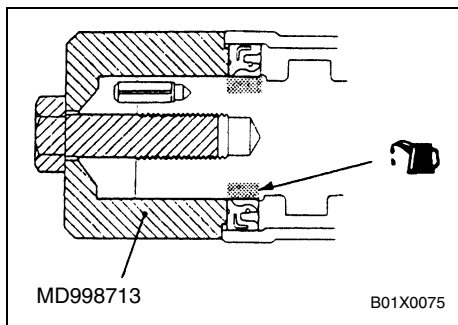
Before removing the lash adjuster, rocker arm and shaft assembly, install the special tools as shown in the illustration so that the lash adjuster will not fall out.



INSTALLATION SERVICE POINTS

▶A◀ LASH ADJUSTER, EXHAUST ROCKER ARM AND SHAFT ASSEMBLY/LASH ADJUSTER, INTAKE ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

Position the rocker arm shaft so that their notches point the direction shown, and install the lash adjuster, rocker arm and shaft assembly.



► B ◀ CAMSHAFT OIL SEAL INSTALLATION

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

<Added>

1. Align matchmarks on the camshaft sprocket and the timing belt that have been put during removal, and install the camshaft sprocket.

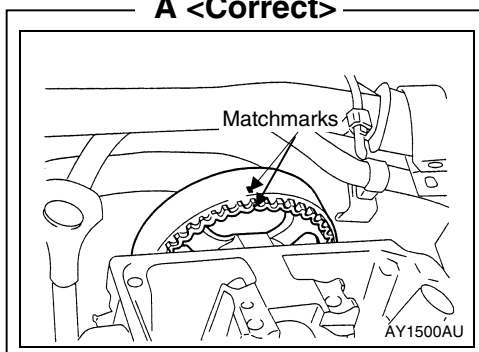
► C ◀ CAMSHAFT SPROCKET INSTALLATION

2. 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.

<Added>

Tightening torque: 88 Nm

A <Correct>



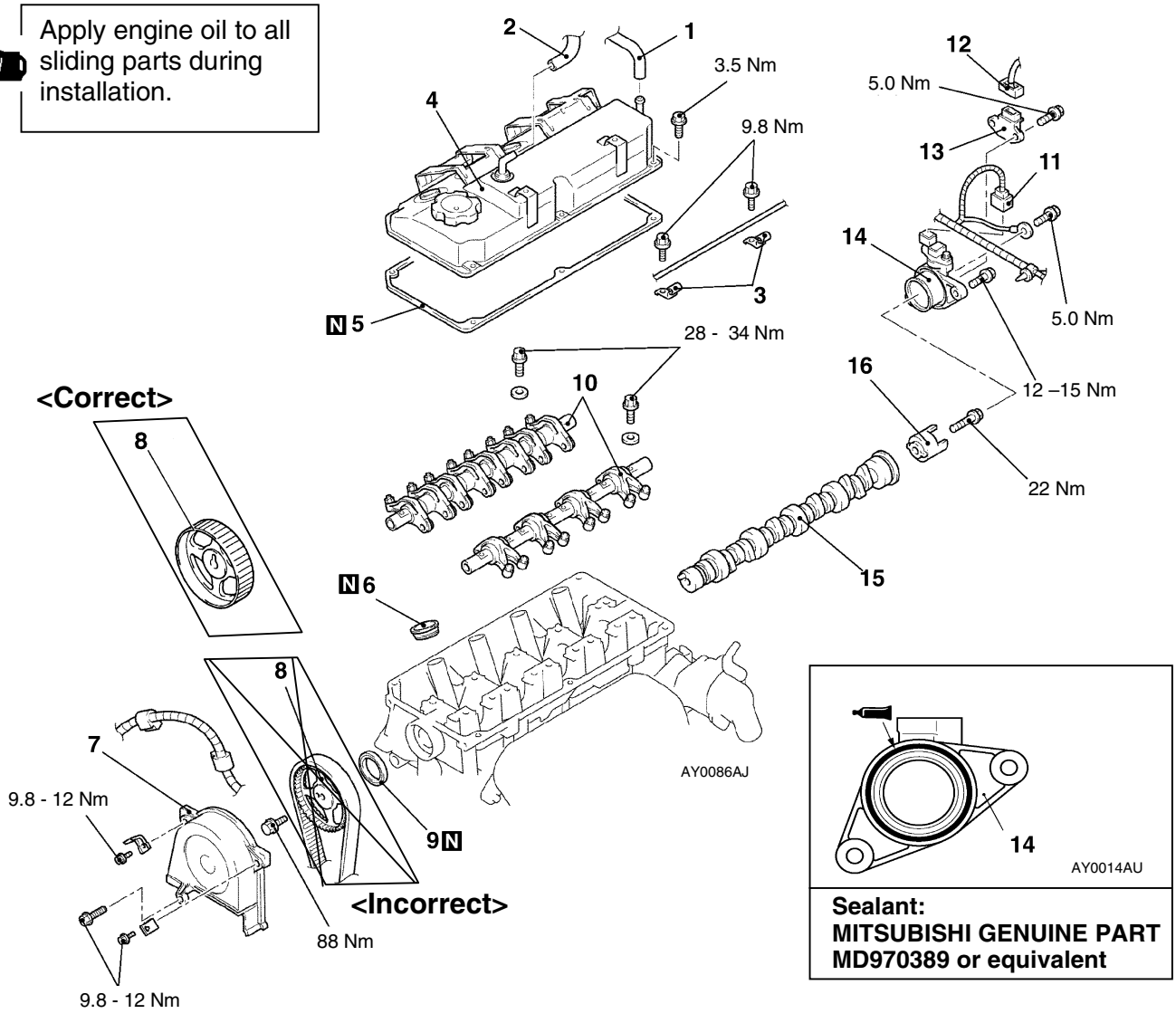
CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation
- Ignition Coil Removal and Installation (Refer to GROUP 16.)

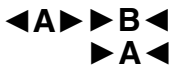
Apply engine oil to all sliding parts during installation.

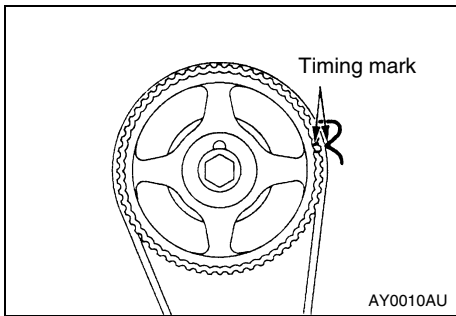


Sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent

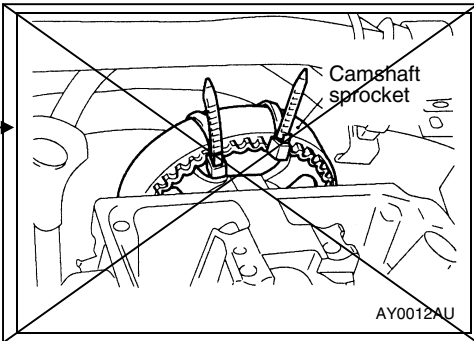
Removal steps

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Breather hose 2. PCV hose 3. Accelerator cable clamp 4. Rocker cover 5. Rocker cover gasket 6. Spark plug guide 7. Timing belt front upper cover 8. Camshaft sprocket 9. Camshaft oil seal | <ol style="list-style-type: none"> 10. Rocker arm and shaft assembly 11. Camshaft position sensor connector 12. Ignition failure sensor connector 13. Ignition failure sensor 14. Camshaft position sensor support 15. Camshaft 16. Camshaft position sensing cylinder |
|---|---|





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<Incorrect>

REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that No. 1 cylinder is at the compression TDC.

Caution

Always turn the crankshaft in the forward direction (clockwise).

2. ~~Secure the camshaft sprocket and the timing belt with band cables to prevent deviation from the relative positions between the camshaft sprocket and the timing belt.~~

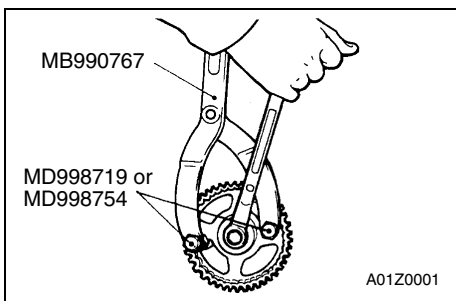
<Correct>

Put matchmarks on the camshaft sprocket and the timing belt.

3. Use the special tool to stop the camshaft sprocket from turning.
4. Remove the camshaft sprocket with the timing belt attached.

Caution

Do not turn the crankshaft after the camshaft sprocket is removed.



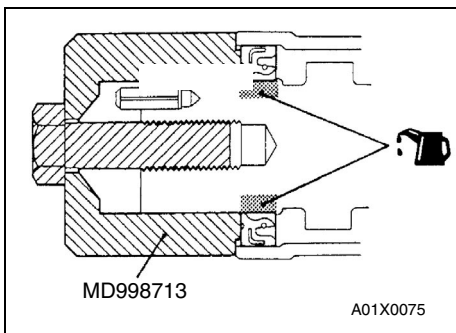
INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT OIL SEAL INSTALLATION

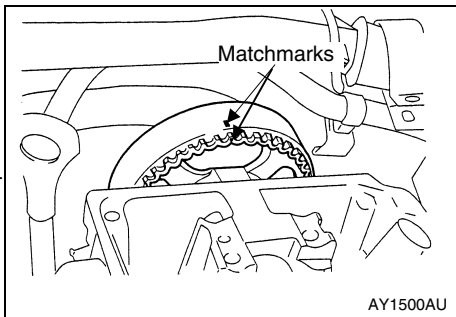
1. Apply engine oil to the camshaft oil seal lip.
2. Use the special tool to press-fit the camshaft oil seal.

<Added>

1. Align matchmarks on the camshaft sprocket and the timing belt that have been put during removal, and install the camshaft sprocket.



<Correct>



▶B◀ CAMSHAFT SPROCKET INSTALLATION

2. 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.

Tightening torque: 88 Nm

<Added>