

GENERAL INFORMATION

Item		4G94
Total displacement mL		1,999
Bore × Stroke mm		81.5 × 95.8
Compression ratio		9.5
Combustion chamber		Pentroof type
Camshaft arrangement		SOHC
Number of valve	Intake	8
	Exhaust	8
Valve timing	Intake opening	BTDC 2°
	Intake closing	ABDC 58°
	Exhaust opening	BBDC 58°
	Exhaust closing	ATDC 10°
Fuel system		Electronically controlled multipoint fuel injection
Rocker arm		Roller type
Auto-lash adjuster		Not equipped

SERVICE SPECIFICATIONS

Item		Standard value	Limit
Alternator drive belt tension (When checked)	Vibration frequency Hz	143 – 185	–
	Tension N	294 – 490	–
	Deflection mm (Reference)	9.7 – 12.9	–
Alternator drive belt tension (When adjusted)	Vibration frequency Hz	155 – 175	–
	Tension N	343 – 441	–
	Deflection mm (Reference)	10.5 – 12.0	–
Alternator drive belt tension (When replaced)	Vibration frequency Hz	203 – 234	–
	Tension N	588 – 784	–
	Deflection mm (Reference)	6.7 – 8.5	–
Power steering oil pump and A/C compressor drive belt tension (When checked)	Vibration frequency Hz	114 – 139	–
	Tension N	392 – 588	–
	Deflection mm (Reference)	10.0 – 12.0	–
Power steering oil pump and A/C compressor drive belt tension (When adjusted)	Vibration frequency Hz	121 – 133	–
	Tension N	441 – 539	–
	Deflection mm (Reference)	10.0 – 11.0	–

11A ENGINE BASE – Service Specifications/Sealants

Item		Standard value	Limit
Power steering oil pump and A/C compressor drive belt tension (When replaced)	Vibration frequency Hz	145 – 166	–
	Tension N	637 – 833	–
	Deflection mm (Reference)	7.0 – 9.0	–
Valve clearance (at hot) mm	Intake valve	0.20	–
	Exhaust valve	0.30	–
Basic ignition timing		5° BTDC ± 3°	–
Ignition timing		Approx. 8° BTDC	–
Idle speed r/min		700 ± 50	–
CO contents %		0.5 or less	–
Compression pressure (200 r/min) kPa		1,559	Min. 1,128
Compression pressure difference of all cylinders kPa		–	Max. 98
Intake manifold vacuum kPa		–	Min. 60
Cylinder head bolt shank length mm		–	96.4

SEALANTS

Item	Specified Sealant	Remark
Camshaft position sensor support	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Upper oil pan		
Lower oil pan		
Flywheel bolt <M/T> or Drive plate bolt <A/T>	3M Stud Locking 4170 or equivalent	–

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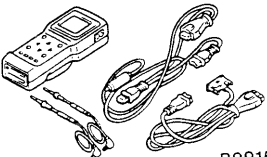
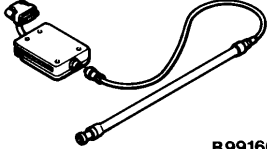
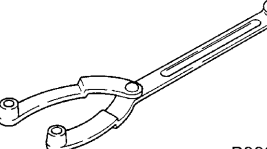
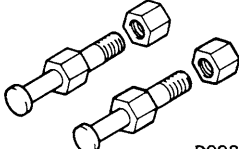
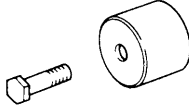
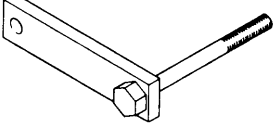
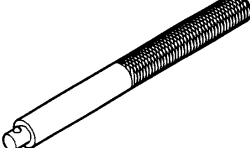
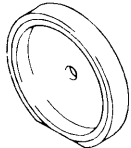

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SPECIAL TOOLS

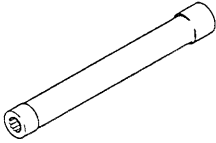
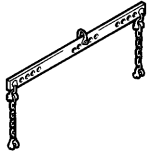
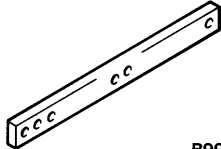
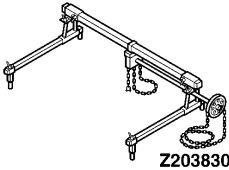
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Tool	Number	Designation	Application
 B991502	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> Measuring the drive belt tension Checking the ignition timing Checking the idle speed
 B991668	MB991668	Belt tension meter set	Measuring the drive belt tension (used together with the MUT-II)
 B990767	MB990767	Front hub and flange yolk holder	<ul style="list-style-type: none"> Holding the crankshaft pulley Holding the camshaft sprocket
 D998719	MD998719	Crankshaft pulley holder pin	
	MD998713	Camshaft oil seal installer	Installation of the camshaft oil seal
	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>
	MB990938	Installer bar	Installation of the crankshaft rear oil seal
	MD998776	Crankshaft rear oil seal installer	
	MD998717	Crankshaft front oil seal installer	Installation of the crankshaft front oil seal

11A ENGINE BASE – Special Tools

Tool	Number	Designation	Application
	MB991653	Cylinder head bolt wrench	Removal and installation of the cylinder head bolts
 B991454	MB991454	Engine hanger balance	Supporting the engine assembly during removal and installation of the transmission (Engine lifter MZ203827 can also be used instead of engine hanger MB991895.)
 B991527	MB991527	Engine hanger	
 Z203830	MB991895	Engine hanger	

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ON-VEHICLE SERVICE

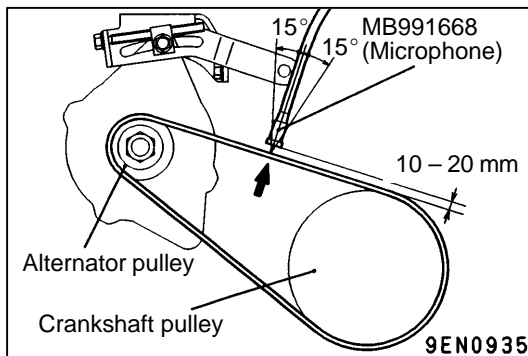
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Check the drive belt tension in the following procedure.

Standard value:

Vibration frequency Hz	143 – 185
Tension N	294 – 490
Deflection (Reference value) mm	9.7 – 12.9

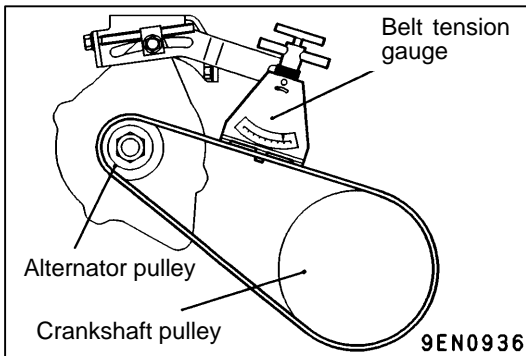


<When using the MUT-II>

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" position 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.

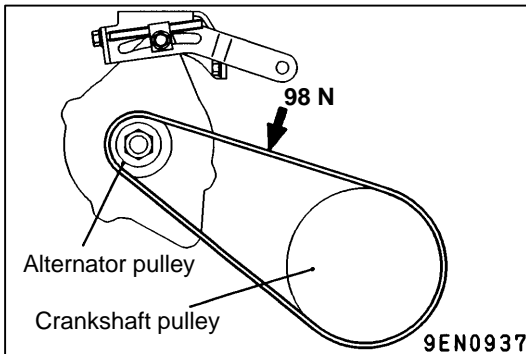
Caution

- (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.



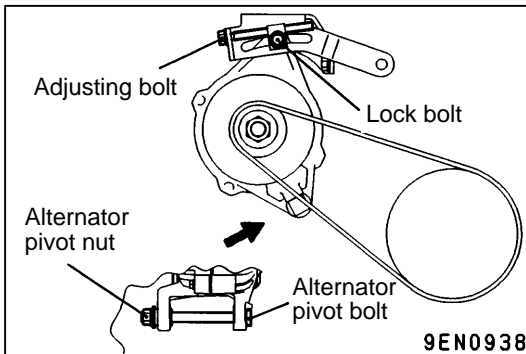
<When using a tension gauge>

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 adjusted	When replaced
Vibration frequency Hz	155 – 175	203 – 234
Tension N	343 – 441	588 – 784
Deflection (Reference value) mm	10.5 – 12.0	6.7 – 8.5

4. Tighten the nut of the alternator pivot bolt.

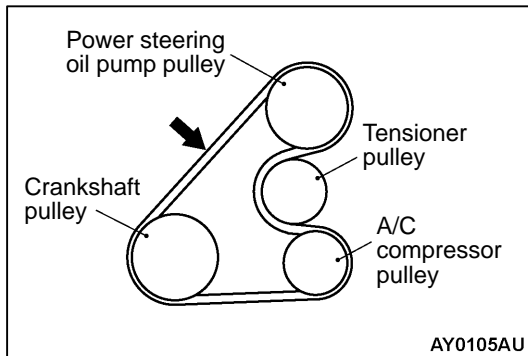
Tightening torque: 44 ± 10 N·m

5. Tighten the lock bolt.

Tightening torque: 22 ± 2 N·m

6. Tighten the adjusting bolt.

Tightening torque: 5 ± 1 N·m



POWER STEERING OIL PUMP AND A/C COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

1. Check the tension of the drive belt as follows.

Standard value:

Item	When checked	When adjusted	When replaced
Vibration frequency Hz	114 – 139	121 – 133	145 – 166
Tension N	392 – 588	441 – 539	637 – 833
Deflection mm (Reference)	10.0 – 12.0	10.0 – 11.0	7.0 – 9.0

<When using MUT-II>

Press the middle (arrow part) of pulley shown in the figure with the fingertip, and check that the vibration frequency of the belt is within the standard value.

NOTE

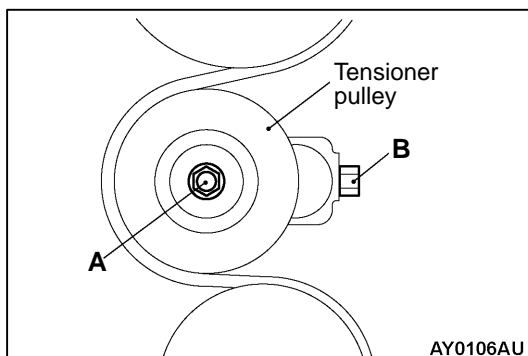
Measure the vibration frequency using the MUT-II.

<When using the tension gauge>

Check that the tension of the belt is within the standard value using a belt tension gauge.

<When checking the deflection>

Apply a force of 98 N to the middle (arrow part) of pulley shown in the figure, and check that the deflection is within the standard value.



2. Adjust the tension as follows if outside the standard value.

- (1) Loosen the tensioner pulley lock nut A.
- (2) Adjust the belt tension using the adjusting bolt B.
- (3) Tighten the tensioner pulley lock nut A at the specified torque.

Tightening torque: 26 ± 4 N·m

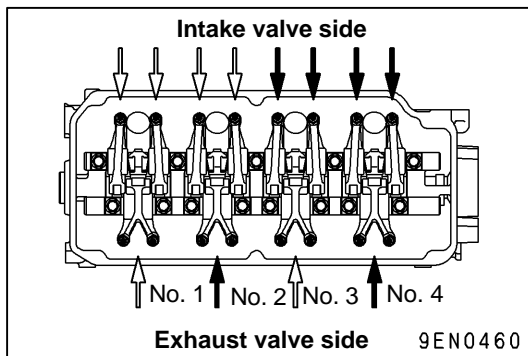
- (4) Check the belt tension, and re-adjust if necessary.

Caution

Check after turning the crankshaft in the normal direction (to the right) for more than one round.

VALVE CLEARANCE CHECK AND ADJUSTMENT

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.

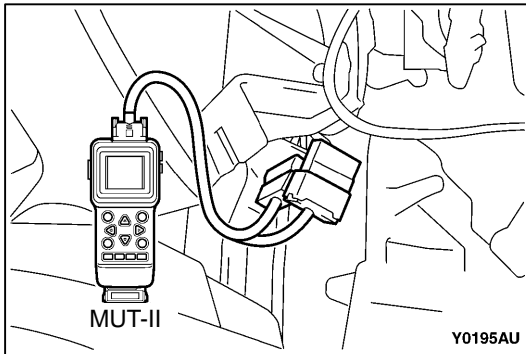


6. Valve clearance inspection and adjustment can be performed on rocker arms indicated by white arrow mark when the No. 1 cylinder piston is at the top dead centre on the compression stroke, and on rocker arms indicated by black arrow mark when the No. 4 cylinder piston is at the top dead centre on the 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.
- Tightening torque: 9 ± 1 N·m**
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 ± 4 N·m



IGNITION TIMING CHECK

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

Standard value: approx. 700 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 [Troubleshooting](#).
9. Press the MUT-II clear key (Select a forced driving cancel mode) to release the Actuator test.

Caution

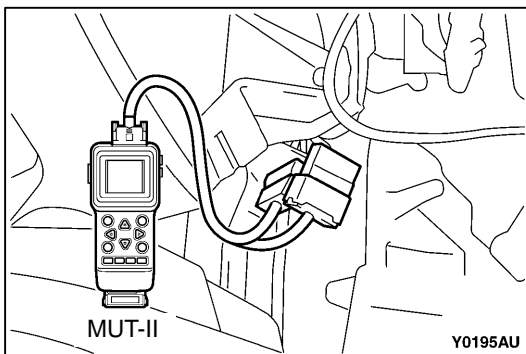
If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

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

Standard value: approx. 8° BTDC

NOTE

- (1) The 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

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

Standard value: 5° BTDC ± 3°

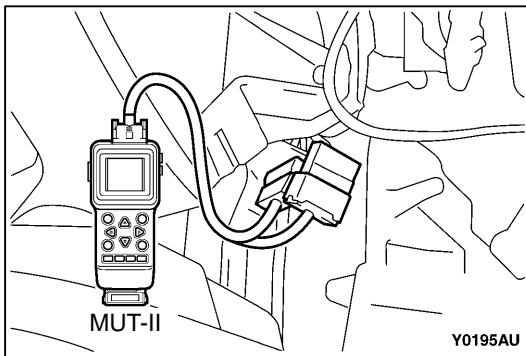
4. Run the engine at idle for 2 minutes.
5. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

Curb idle speed: 700 ± 50 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, check the MPI components by referring to [Troubleshooting](#).



IDLE MIXTURE CHECK

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

Standard value: 5° BTDC ± 3°

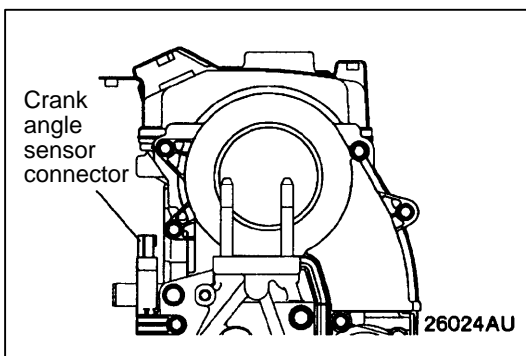
4. Run the engine at 2,500 r/min for 2 minutes.
5. Set the CO tester.
6. Check the CO contents at idle.

Standard value: 0.5% or less

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

NOTE

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



COMPRESSION PRESSURE CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Disconnect the spark plug cables.
3. Remove all of the spark plugs.
4. Disconnect the crank angle sensor connector.

NOTE

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

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

Caution

- (1) Keep away from the spark plug hole when cranking.
- (2) If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.
6. Set compression gauge to one of the spark plug holes.

7. Crank the engine with the throttle valve fully open and measure the compression pressure.

Standard value (at engine speed of 200 r/min):
1,559 kPa

Limit (at engine speed of 200 r/min):
Min. 1,128 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. 98 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 from (6) to (8).

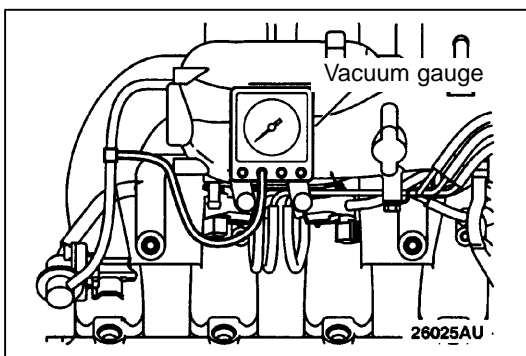
(1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.

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

10. Connect the crank angle sensor connector.
11. Install the spark plugs and spark plug cables.
12. Use the MUT-II to erase the diagnosis codes.

NOTE

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



MANIFOLD VACUUM CHECK

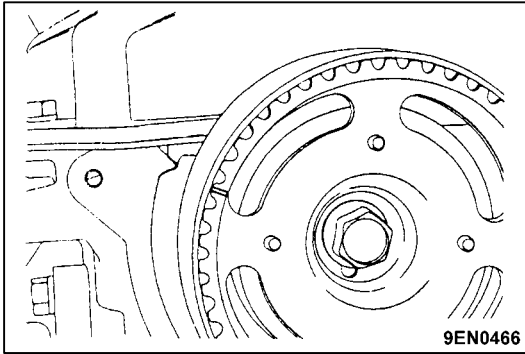
1. Set the vehicle to the pre-inspection condition.
2. Set the engine tachometer or connect the MUT-II.
3. Check that the idle speed is within the standard value.

NOTE

When using the MUT-II, select the code No. 22.

4. Connect the three-way union joint to the vacuum hose between the fuel pressure regulator and the air intake plenum, and connect a vacuum gauge.
5. Check the manifold vacuum at idle.

Limit: 60 kPa



TIMING BELT TENSION ADJUSTMENT

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.

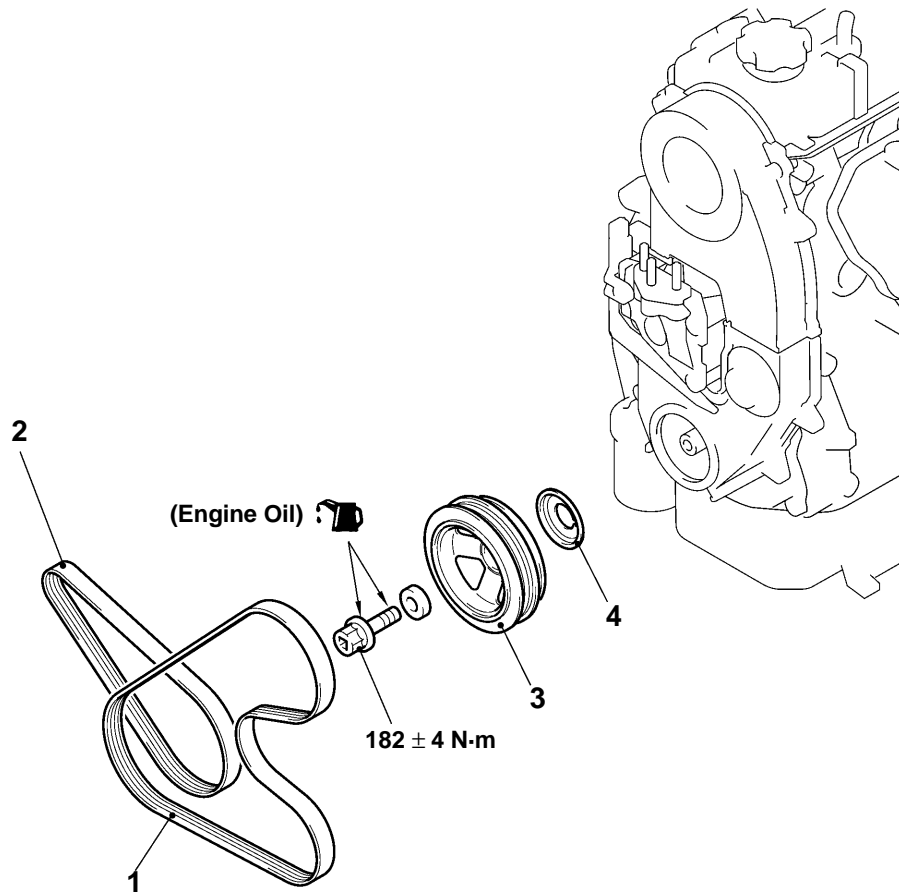
5. Tighten the timing belt tensioner fixing bolt.
6. Install the access cover.
7. Install the timing belt upper cover.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Undercover Removal and Installation
- [Drive Belt Tension Adjustment](#) <only after installation>



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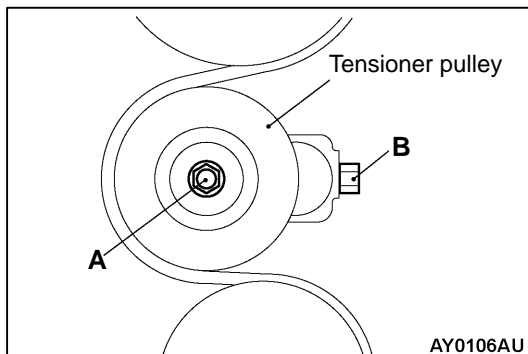
Removal steps



1. Power steering oil pump and A/C compressor drive belt
2. Alternator drive belt



3. Crankshaft pulley
4. Crankshaft sprocket flange



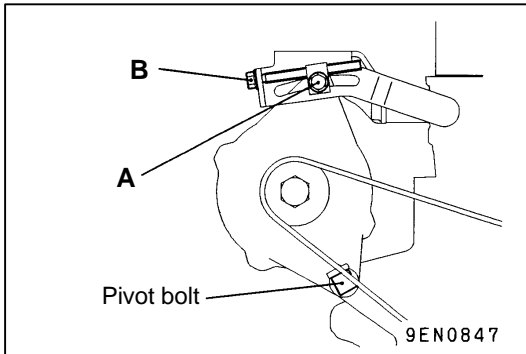
REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND A/C COMPRESSOR DRIVE BELT REMOVAL

1. Loosen locking nut A of tensioner pulley.
2. Rotate adjusting bolt B anti-clockwise (in left turn), and remove drive belt.

Caution

When the drive belt is reused, use a chalk, etc. to indicate an arrow of rotation direction (right turn) on the back of the belt.

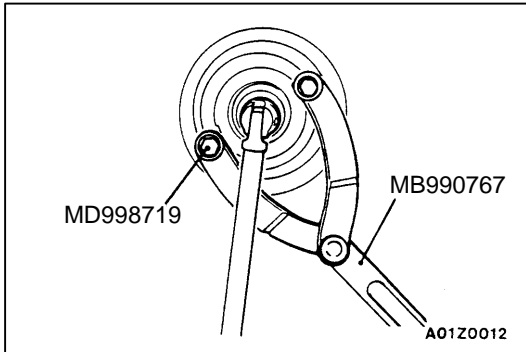


◀B▶ ALTERNATOR DRIVE BELT REMOVAL

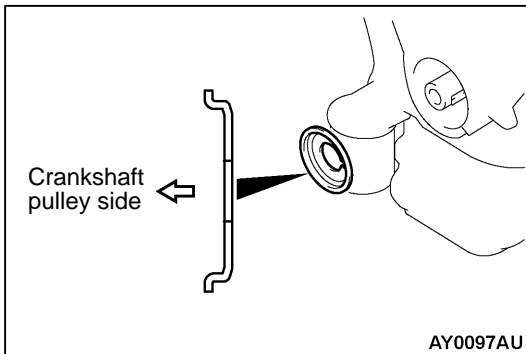
1. Loosen nut for alternator pivot bolt and locking bolt A.
2. Rotate adjusting bolt B anti-clockwise (in left turn), and remove drive belt.

Caution

When the drive belt is reused, use a chalk, etc. to indicate an arrow of rotation direction (right turn) on the back of the belt.



◀C▶ CRANKSHAFT PULLEY REMOVAL



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT SPROCKET FLANGE INSTALLATION

Install crankshaft sprocket flange in the direction specified in the figure.

▶B◀ CRANKSHAFT PULLEY INSTALLATION

1. Clean the tapped holes on crankshaft to eliminate oil fouled, etc.
2. Apply engine oil at the contact surfaces and threads on crankshaft bolts.
3. Use the same special tool as in the removal procedure to retain crankshaft pulley, and tighten crankshaft bolts to the specified torque.

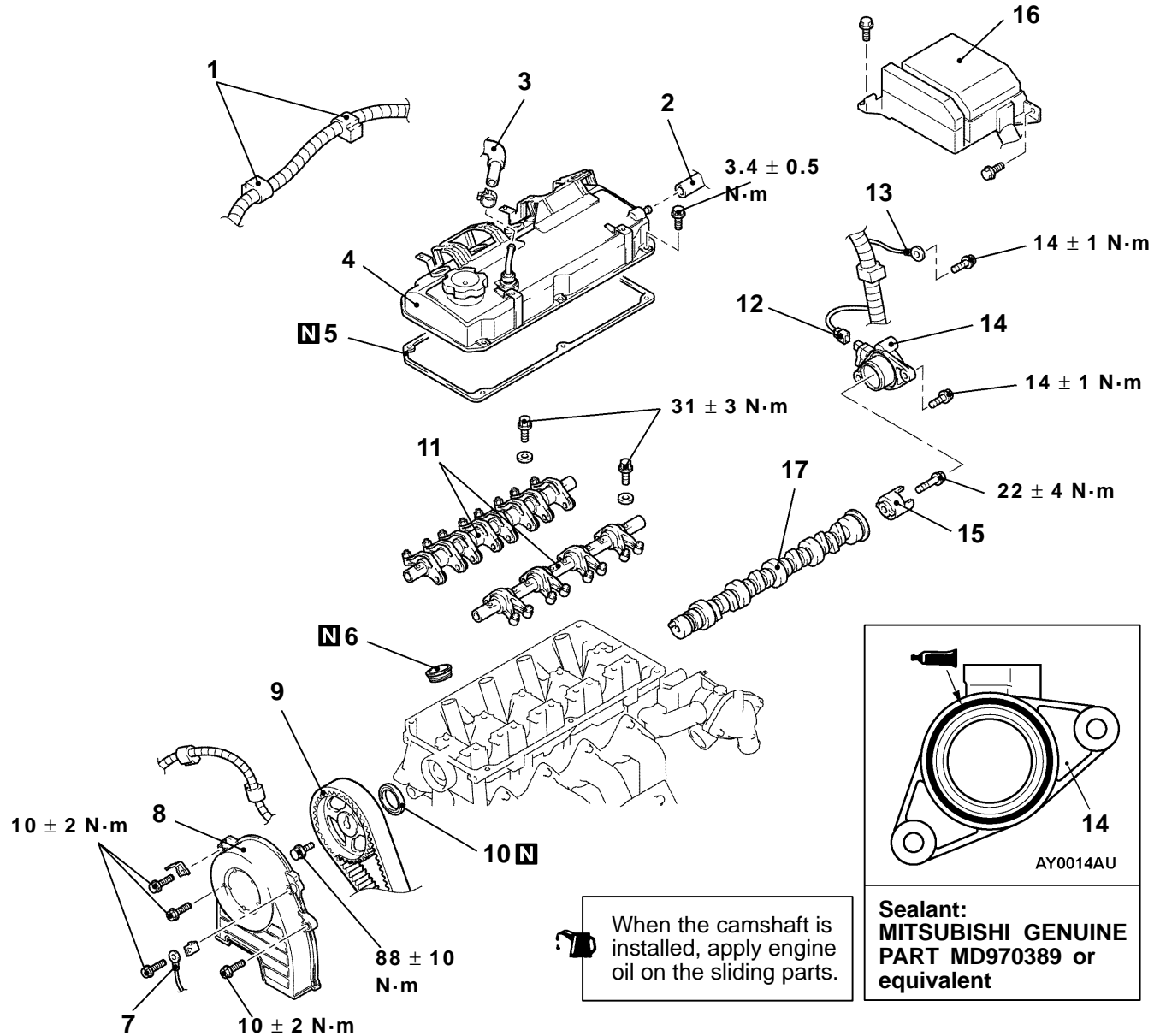
Tightening torque: 182 ± 4 N·m

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation
- Ignition Coil Removal and Installation

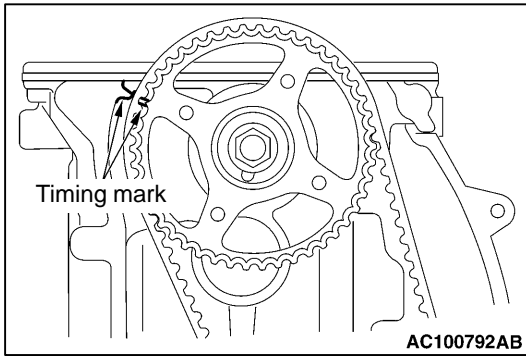


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Removal steps

1. Control harness connection
2. Breather hose connection
3. PCV hose connection
4. Rocker cover
5. Rocker cover gasket
6. Spark plug guide oil seal
- Valve clearance adjustment
7. Earth cable connection
8. Timing belt front upper cover
9. Camshaft sprocket

10. Camshaft oil seal
11. Rocker arm and shaft assembly
12. Camshaft position sensor connector
13. Earth cable connection
14. Camshaft position sensor support
15. Camshaft position sensor sensing cylinder
16. Relay box mounting bolt
17. Camshaft



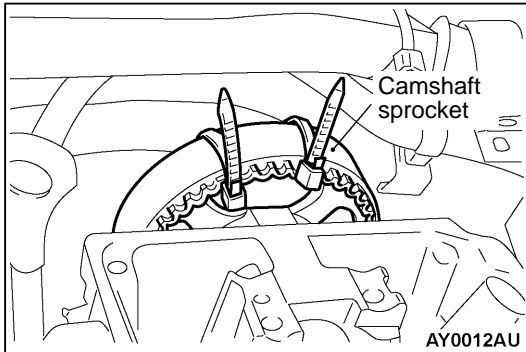
REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

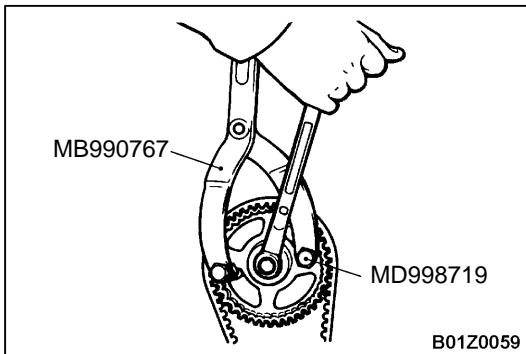
1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that No.1 cylinder is at the compression TDC.

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.



3. Use the special tool to stop the camshaft sprocket from turning.
4. Remove the camshaft sprocket.

Caution

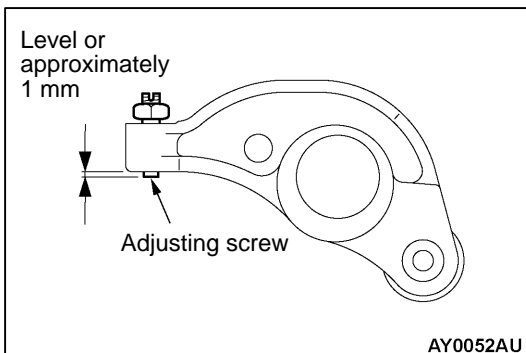
Do not turn the crankshaft after the camshaft sprocket is removed.

◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

Loosen the rocker arm and shaft assembly mounting bolt, and then remove the rocker arm and shaft assembly with the bolt still attached.

Caution

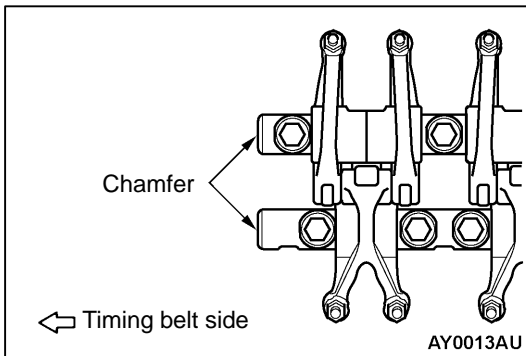
Never disassembly the rocker arm and shaft assembly.



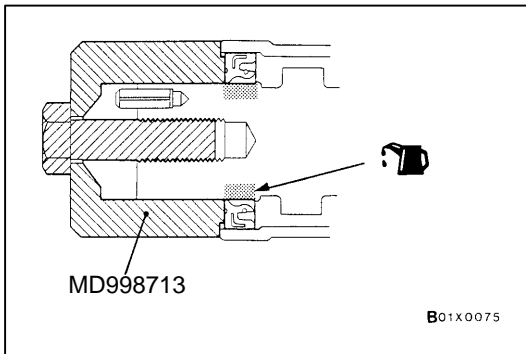
INSTALLATION SERVICE POINTS

▶A◀ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. As shown in the figure, level the adjusting screw to the rocker arm edge surface, or protrude it by approximately 1 mm.

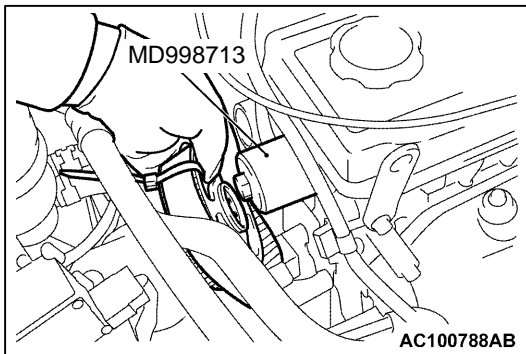


2. With the larger chamfer side of the rocker arm shaft as the direction shown in the figure, install the the rocker arm and shaft assembly.



►B◄ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil on the circumference of oil seal lip.
2. Press in oil seal as indicated in the figure.



►C◄ CAMSHAFT SPROCKET INSTALLATION

1. Align the marks on the camshaft sprocket and the timing belt drawn during removal, and install the camshaft sprocket.
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.

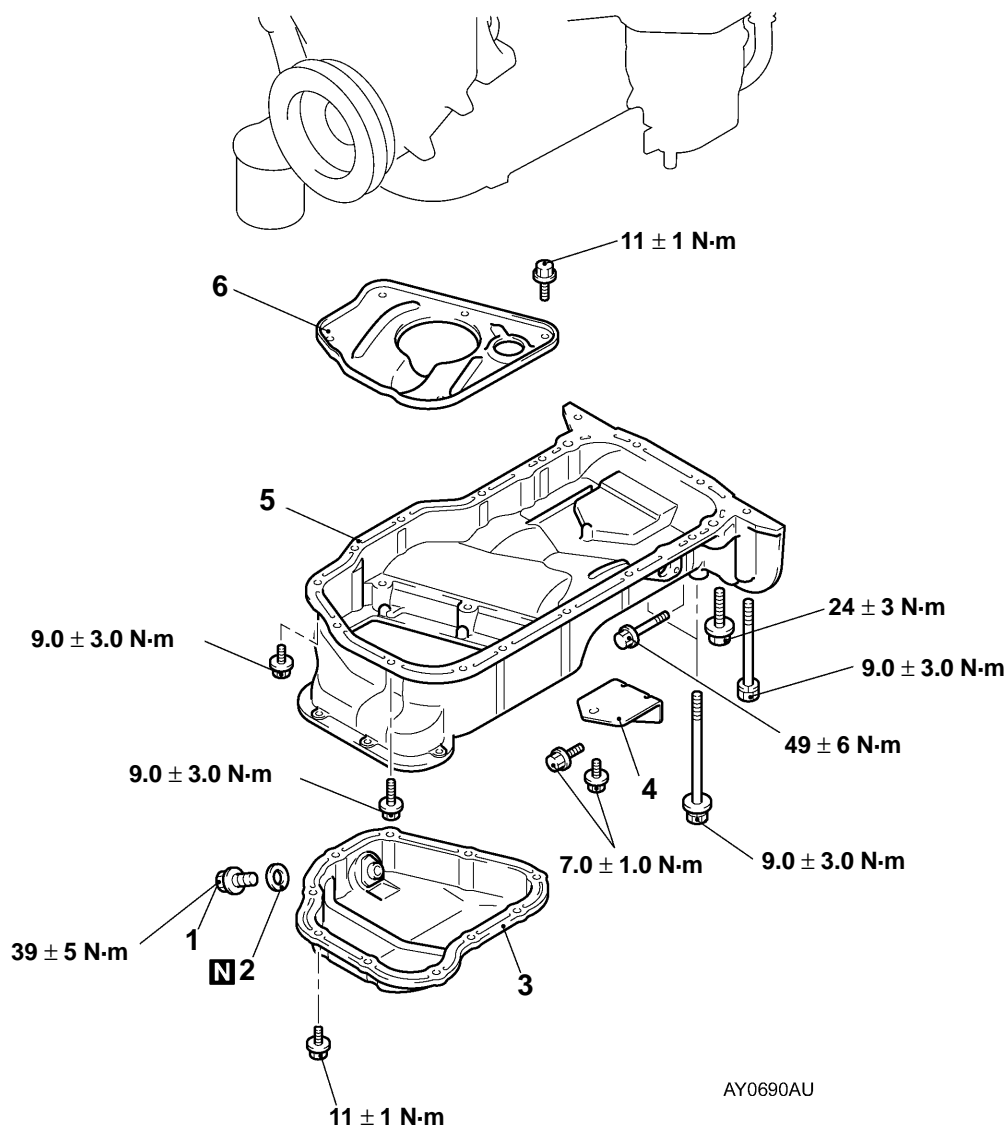
Tightening torque: 88 ± 10 N·m

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

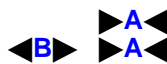
- Undercover Removal and Installation
- Engine Oil Drainage and Refilling
- [Front Exhaust Pipe Removal and Installation](#)

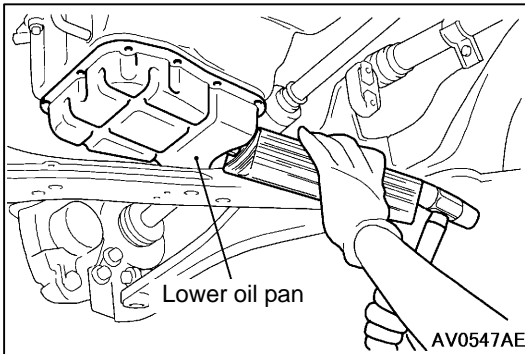
**Removal steps**

1. Drain plug
2. Drain plug gasket
3. Lower oil pan



4. Oil pan cover
5. Upper oil pan
6. Baffle plate





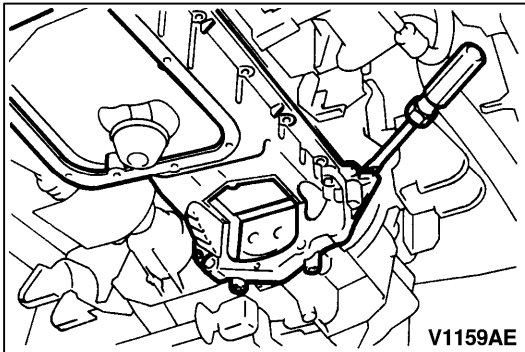
REMOVAL SERVICE POINTS

◀A▶ LOWER OIL PAN REMOVAL

With wood dowel stock contacted on lower oil pan, tap and remove lower oil pan with hammer.

Caution

Due to the use of aluminium upper oil pan, do not use oil pan remover (MD998727).

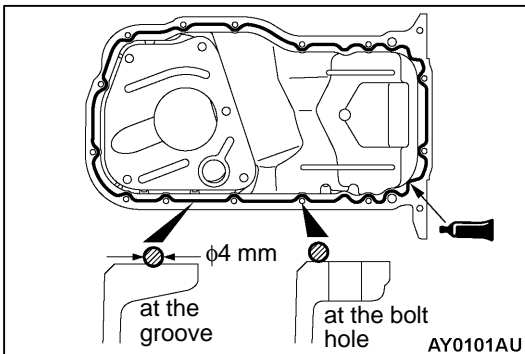


◀B▶ UPPER OIL PAN REMOVAL

When individual mounting bolts are screwed out, insert minus driver into the gap (specified in the figure) between upper oil pan and cylinder block, and pry off upper oil pan.

Caution

Due to the use of aluminium upper oil pan, do not use oil pan remover (MD998727).



INSTALLATION SERVICE POINTS

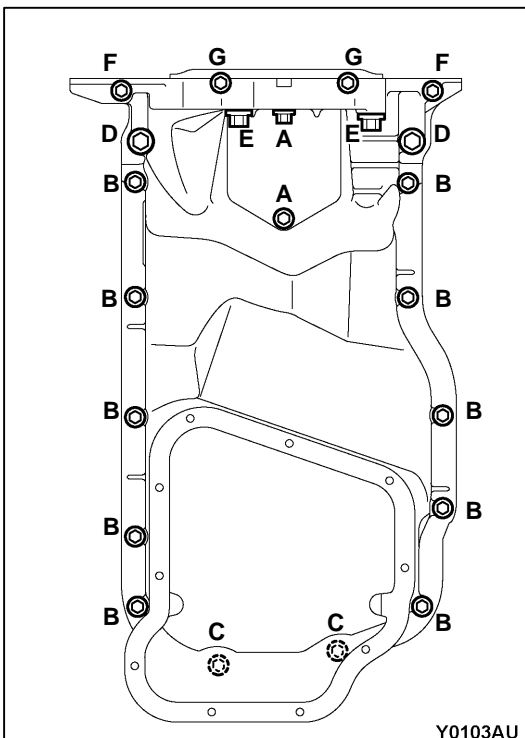
▶A◀ UPPER OIL PAN INSTALLATION

1. With scraper or wire brush, etc., eliminate residual gaskets attached on upper oil pan and cylinder block.
2. Apply sealant on the mounting surface of upper oil pan without any gap as indicated in the figure, and install oil pan on cylinder block.

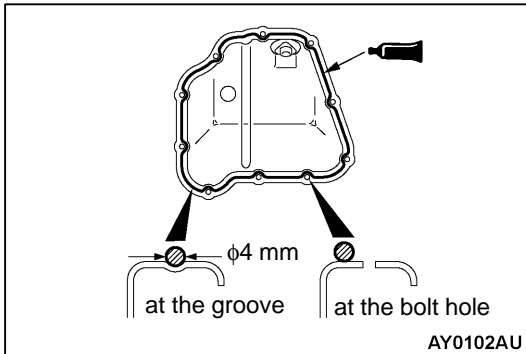
Specified sealant:

mitsubishi GENUINE PART MD970389 or equivalent

3. According to the figure, place individual bolts on the specified positions of upper oil pan and cover, and tighten the bolts to the specified torque.



Designation	Sym- bol	Quan- tity	Dimension (mm) (nominal diame- ter × nominal length)	Tightening torque (N·m)
Flange Bolt	A	2	6 × 10	7.0 ± 1.0
	B	10	6 × 18	9.0 ± 3.0
	C	2	6 × 22	
	D	2	8 × 40	24 ± 3
	E	2	10 × 40	49 ± 6
Bolts with Washers	F	2	6 × 85	9.0 ± 3.0
	G	2	6 × 127	

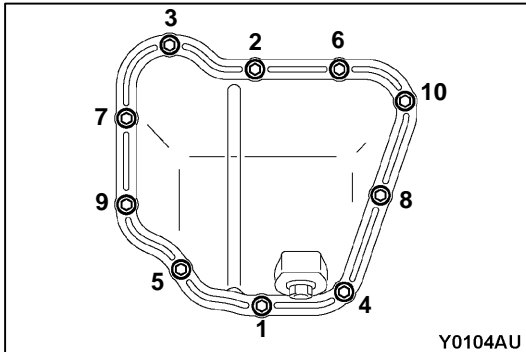


►B◄ LOWER OIL PAN INSTALLATION

1. With scraper or wire brush, etc., eliminate residual gaskets attached on lower oil pan.
2. Apply sealant on the mounting surface of lower oil pan without any gap as indicated in the figure, and install lower oil pan on upper oil pan.

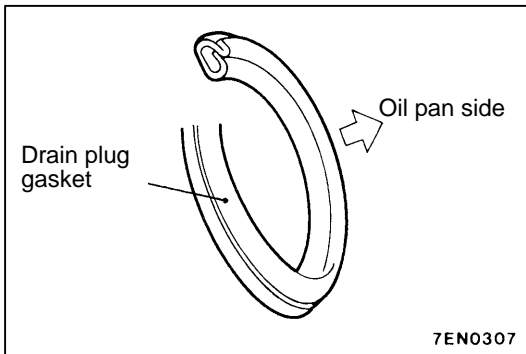
Specified sealant:

mitsubishi GENUINE PART MD970389 or equivalent



3. According to the sequence specified in the figure, tighten mounting bolts of lower oil pan to the specified torque.

Tightening torque: 11 ± 1 N·m



►C◄ DRAIN PLUG GASKET INSTALLATION

Gasket should be replaced with a new one, and install it in the direction specified in the figure.

INSPECTION

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

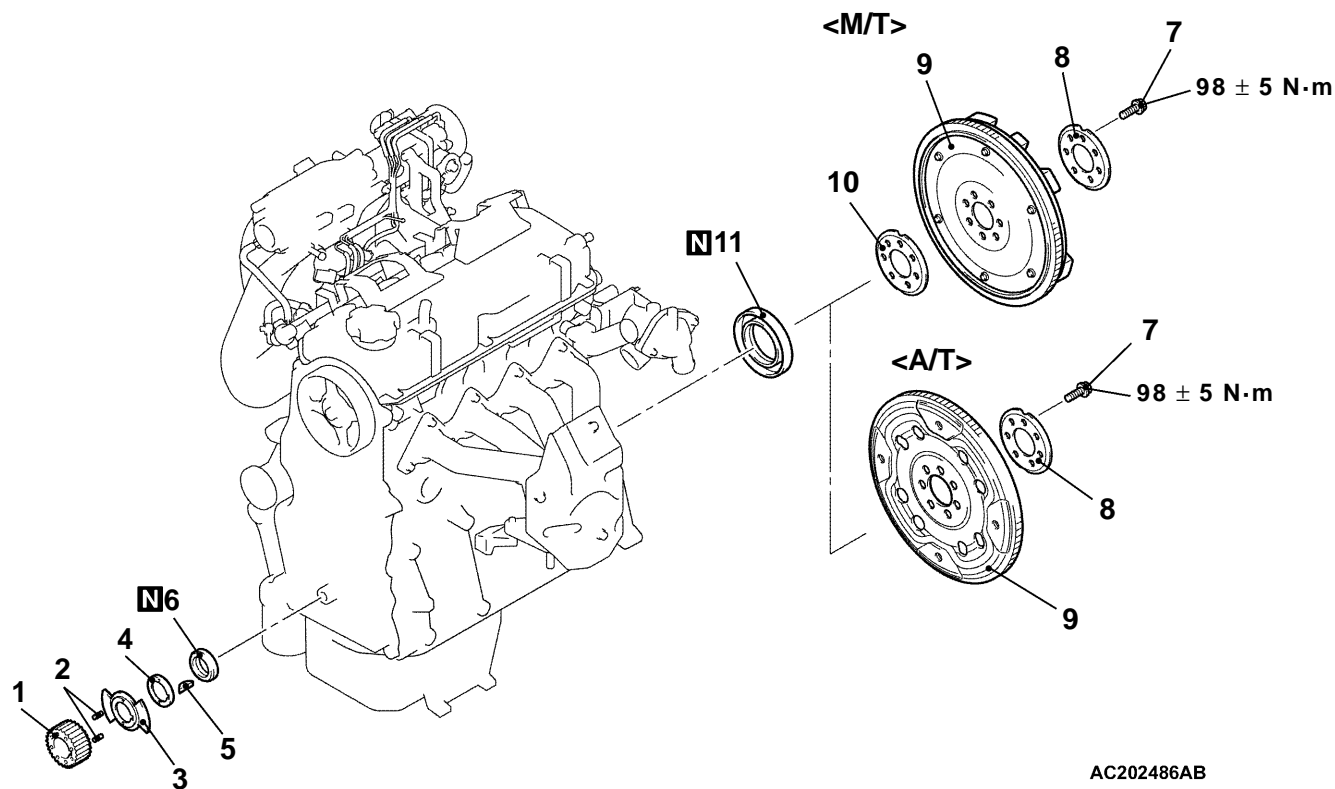
CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

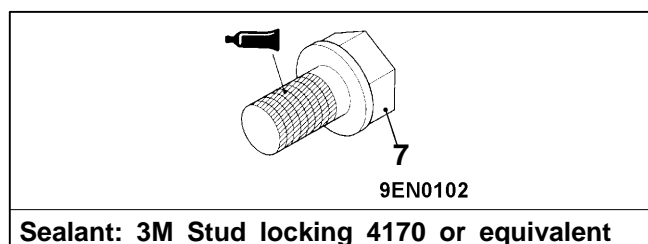
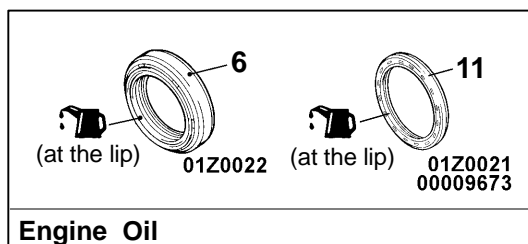
MAIN

Group
11

11A



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Crankshaft front oil seal removal steps

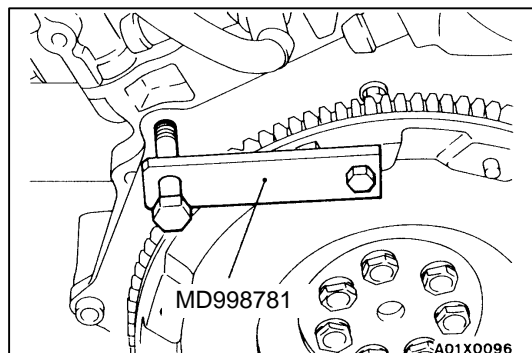
- Timing belt
- Crank angle sensor (Refer to Ignition System.)

- ▶D◀ 1. Crankshaft sprocket
- ▶D◀ 2. Spring pin
- ▶D◀ 3. Crankshaft sensing blade
- ▶D◀ 4. Crankshaft spacer
- ▶C◀ 5. Crankshaft key
- ▶C◀ 6. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

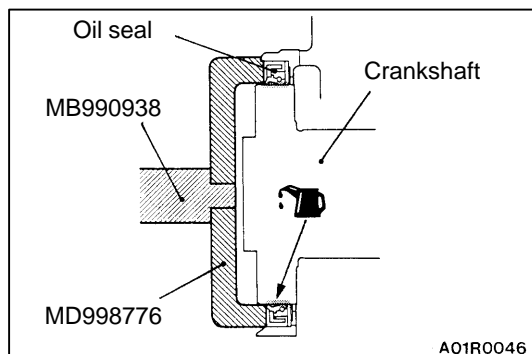
- Transmission assembly (M/T) (A/T)
- Clutch cover and disc <M/T>
- Upper and lower oil pan assembly

- ◀A▶ ▶B◀ 7. Flywheel bolt <M/T> or drive plate bolt <A/T>
- ▶B◀ 8. Adapter plate
- ▶B◀ 9. Flywheel <M/T> or drive plate <A/T>
- ▶B◀ 10. Adapter plate <M/T>
- ▶A▶ 11. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ FLYWHEEL BOLT <M/T> OR DRIVE PLATE BOLT <A/T> REMOVAL



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Apply small quantity of engine oil on the circumference of oil seal lip.
2. Use special tool to press in oil seal up to the chamfered surface of oil seal case.

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

1. Eliminate residual sealant and oil, etc. attached on flywheel <M/T> or drive plate <A/T>, adapter plate and threads of flywheel bolt <M/T> or drive plate bolt <A/T>.
2. Use tap (M11 × 1.0) to eliminate residual sealant attached in the tapped holes on crankshaft, and blow and clean the holes.
3. Apply oil on the contact surface of flywheel bolt <M/T> or drive plate bolt <A/T> and at tapped holes on crankshaft.
4. Apply specified adhesive at tapped hole of flywheel bolt <M/T> or drive plate bolt <A/T>.

Specified sealant:

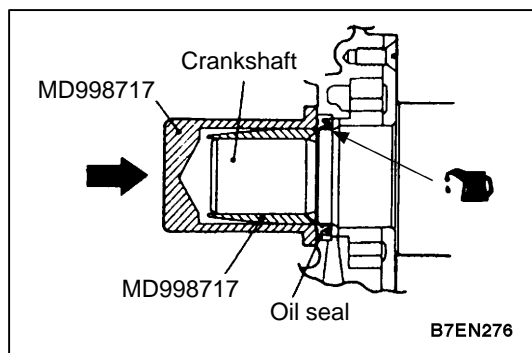
3M Stud locking 4170 or equivalent

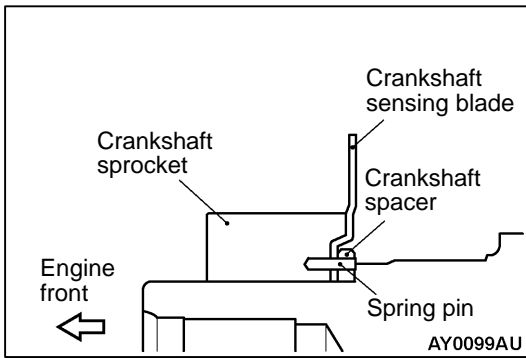
5. Use the same special tool as in the removal procedure to retain flywheel <M/T> or drive plate <A/T>, and tighten flywheel bolt <M/T> or drive plate bolt <A/T> to the specified torque.

Tightening torque: 98 ± 5 N·m

▶C◀ CRANKSHAFT FRONT OIL SEAL

1. Apply small quantity of engine oil on the circumference of oil seal lip.
2. Use special tool to press in oil seal up to the chamfered surface of oil pump case.





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

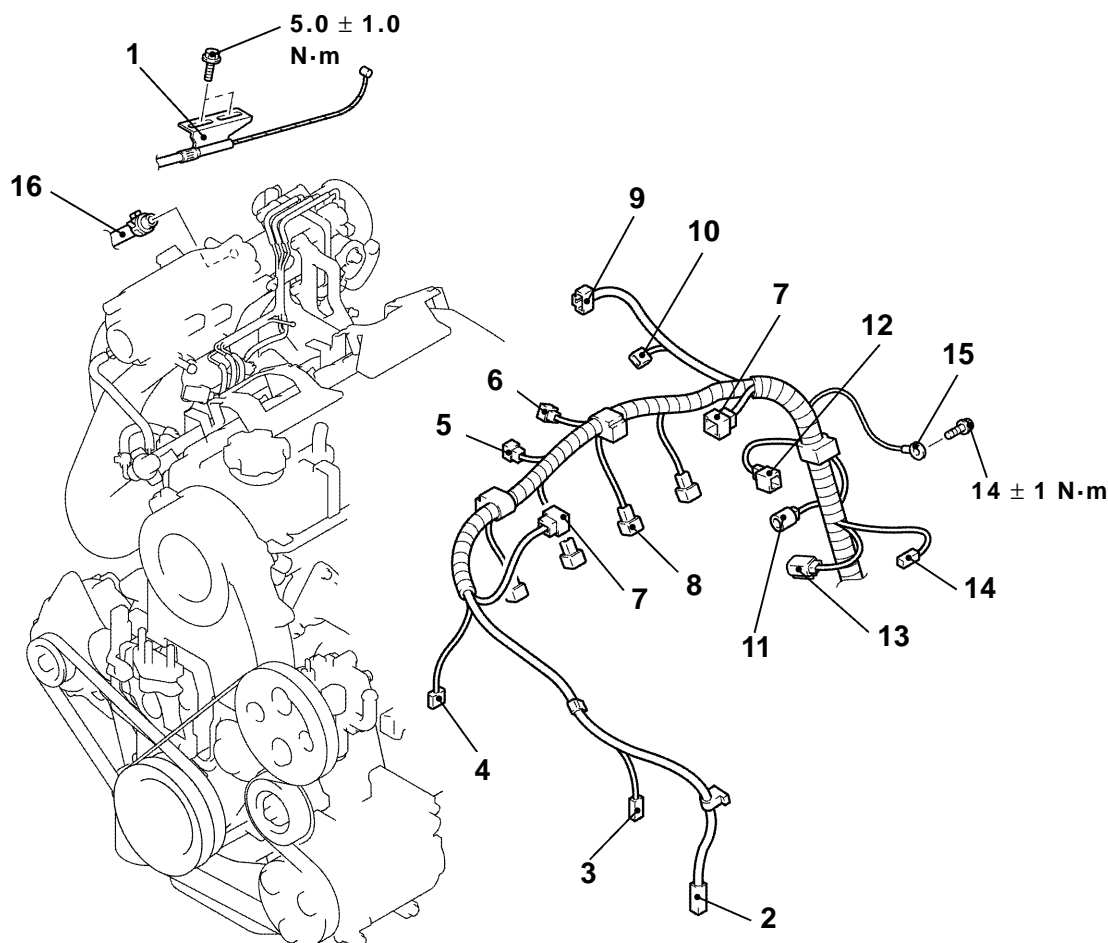
1. Remove oil and lubricant from the mounting surfaces on crankshaft, crankshaft spacer, crankshaft sensing blade and crankshaft sprocket.
2. With spring pin, crankshaft sensing blade and crankshaft spacer assembled, install crankshaft sprocket on crankshaft.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

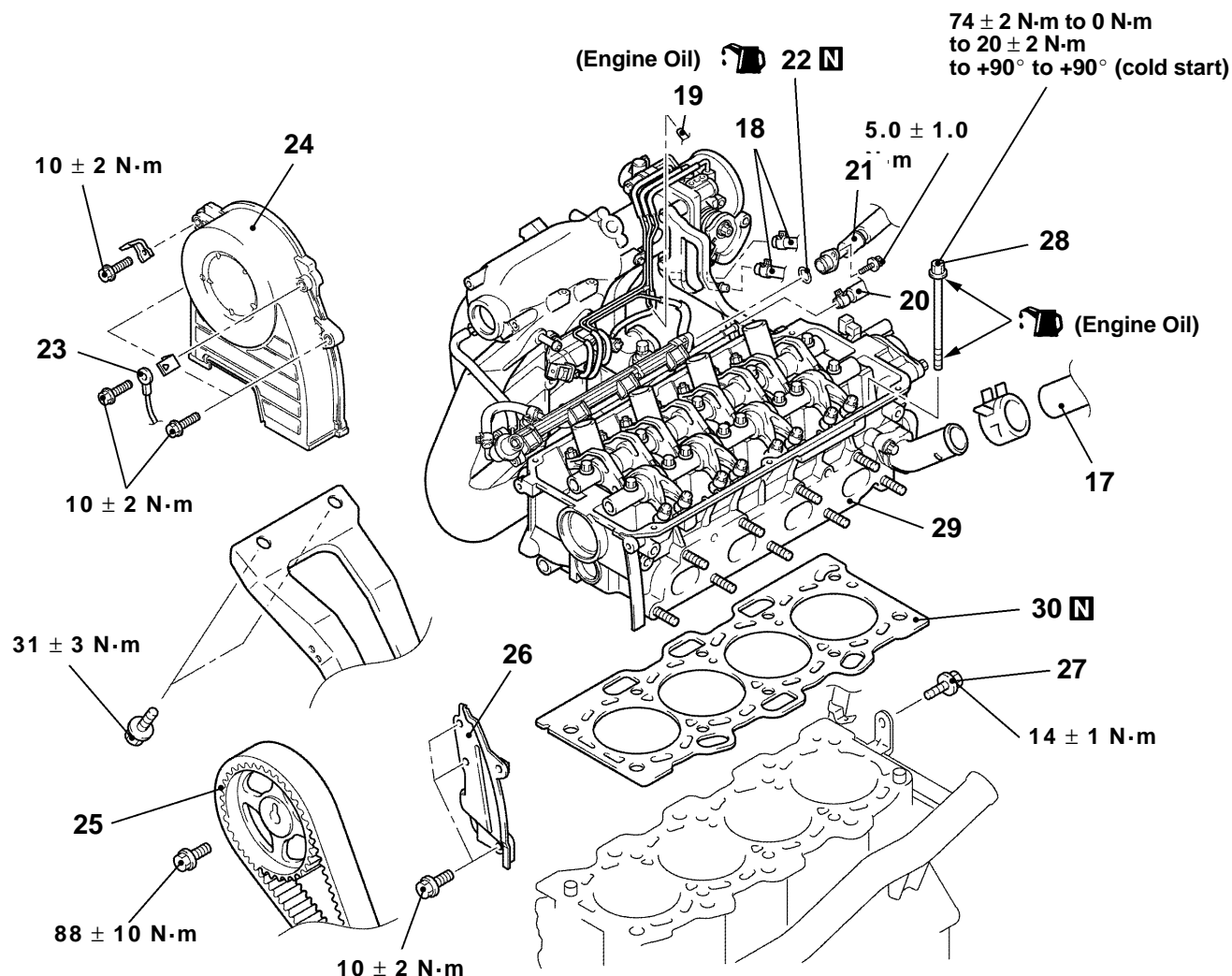
- Fuel Discharge Prevention (Refer to [On-vehicle Service.](#)) <before removal only>
- Fuel Leak Check <after installation only>
- Accelerator Cable Adjustment (Refer to [On-vehicle Service.](#)) <after installation only>
- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying (Refer to [On-vehicle Service.](#))
- Engine Oil Draining and Supplying
- [Air Cleaner Removal and Installation](#)
- [Exhaust Manifold Removal and Installation](#)
- Thermostat Case Assembly Removal and Installation (Refer to [Water Hose and Water Pipe.](#))



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Removal steps

1. Accelerator cable connection
2. A/C compressor connector
3. Power steering oil pressure switch connector
4. Crank angle sensor connector
5. Purge control solenoid valve connector
6. EGR solenoid valve connector
7. Ignition coil connector
8. Injector connector
9. Throttle position sensor connector
10. Idle speed control servo connector
11. Engine coolant temperature sensor connector
12. Camshaft position sensor connector
13. Detonation sensor connector
14. Engine coolant temperature gauge unit connector
15. Earth cable connection
16. Brake booster vacuum hose connection



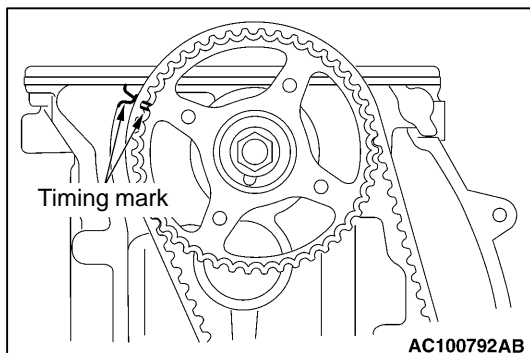
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- | | |
|--|------------------------------------|
| • Ignition coil | 23. Earth cable connection |
| • Rocker cover | 24. Timing belt front upper cover |
| ◀A▶ ▶E▶ 17. Radiator upper hose connection | 25. Camshaft sprocket |
| 18. Water hose connection | 26. Timing belt rear plate |
| 19. Vacuum hose connection | 27. Water inlet pipe mounting bolt |
| 20. Fuel return hose connection | 28. Cylinder head bolt |
| ▶D▶ ▶D▶ 21. Fuel high-pressure hose connection | 29. Cylinder head assembly |
| 22. O-ring | ▶A▶ 30. Cylinder head gasket |

REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE REMOVAL

After making mating marks on the hose and hose clamp, disconnect the hose.

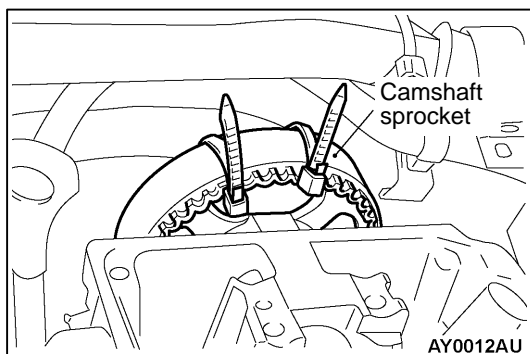


◀B▶ CAMSHAFT SPROCKET REMOVAL

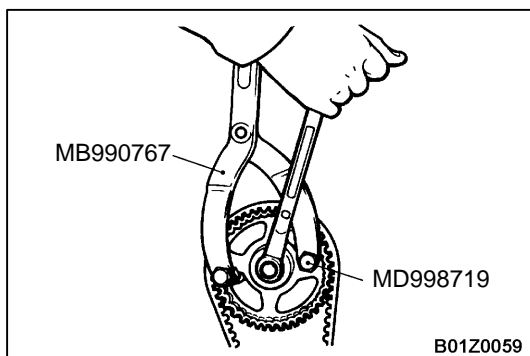
1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that No.1 cylinder is at the compression TDC.

Caution

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



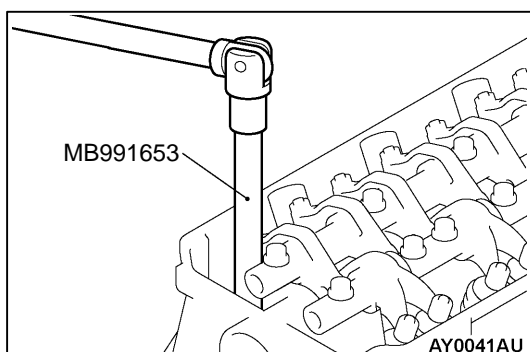
2. Secure the camshaft sprocket and the timing belt with band cables to prevent deviation from the relative positions between the camshaft sprocket and the timing belt.



3. Use the special tool to stop the camshaft sprocket from turning.
4. Remove the camshaft sprocket.

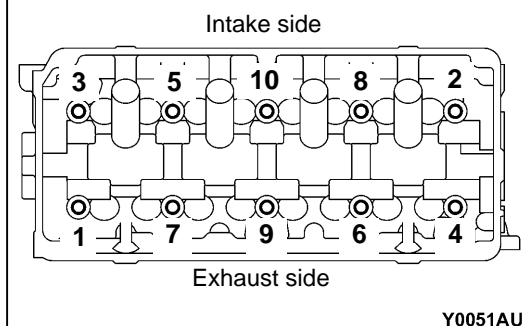
Caution

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



◀C▶ CYLINDER HEAD BOLT REMOVAL

Use special tool to loosen bolts in 2–3 times according to the sequence specified in the figure, and then remove the bolts.



INSTALLATION SERVICE POINTS

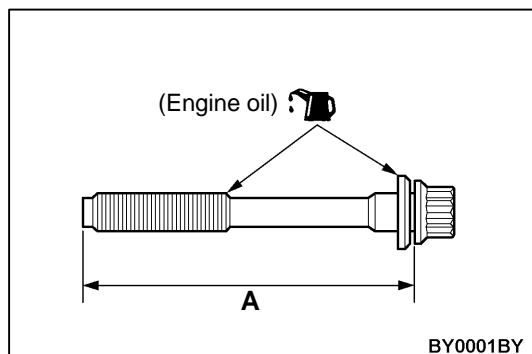
►A◀ CYLINDER HEAD GASKET INSTALLATION

1. Remove residual gasket attached on the mounting surface of the gasket.

Caution

Do not insert foreign objects into coolant, oil passage and cylinders.

2. With individual holes of cylinder head aligned on individual holes of cylinder head gasket, install cylinder head gasket on cylinder head.

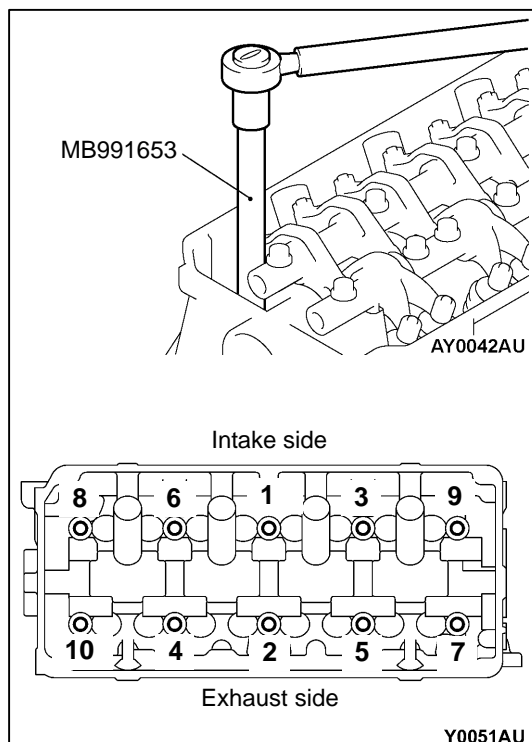


►B◀ CYLINDER HEAD BOLT INSTALLATION

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



3. Use special tool to tighten bolts according to the following procedure (tightening for plastic zone).
 - (1) According to the sequence in the figure, tighten bolts to the specified torque 74 ± 2 N·m.
 - (2) In the reverse sequence of the figure, fully loosen bolts.
 - (3) According to the sequence specified in the figure, tighten bolts to the specified torque 20 ± 2 N·m.
 - (4) Indicate paint markings on the heads of cylinder head bolts and cylinder head, and tighten bolts at the angle of 90 degrees in the sequence specified in the figure.
 - (5) When bolts are tightened at the angle of 90 degrees according to the figure, ensure that the paint markings on the heads of cylinder head bolts and cylinder head are standing in line.

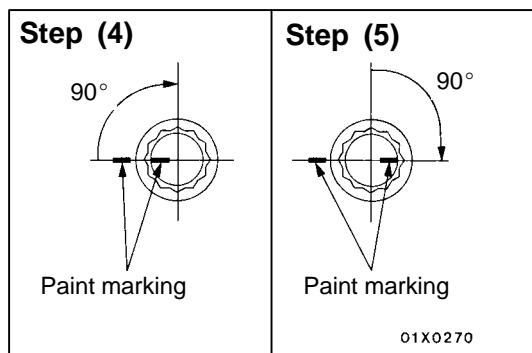
Caution

- 1) When the tightening angle is under 90 degree, the bolt is not sufficiently tightened.
- 2) When the tightening angle exceeds the specified value, remove the bolt and repeat the same procedure beginning with 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 ± 10 N·m



►D◄ O-RING/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 ± 1.0 N·m

►E◄ RADIATOR UPPER HOSE INSTALLATION

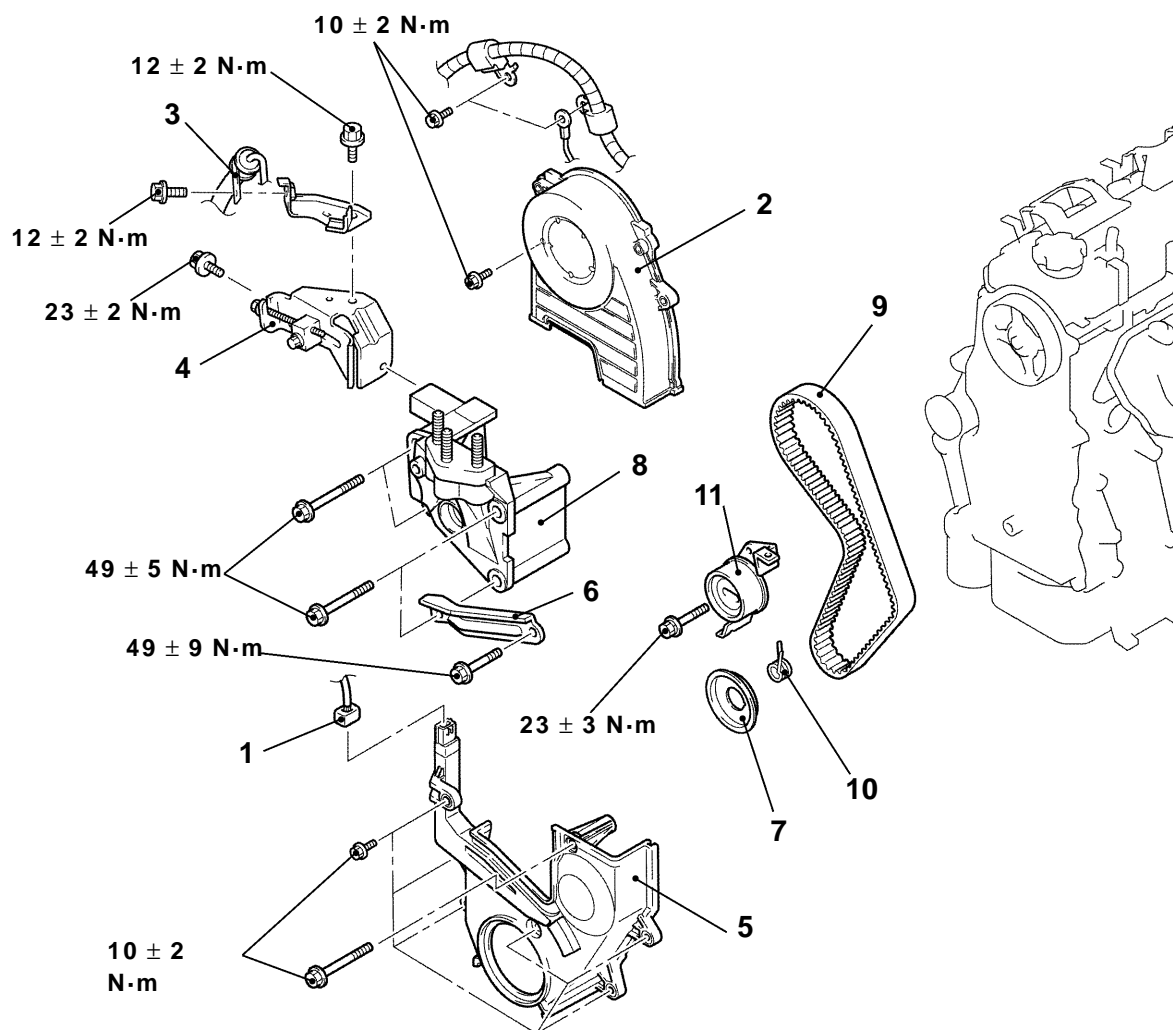
1. Insert radiator upper hose up to the convex of water outlet fitting.
2. With alignment marks on radiator upper hose and hose clamps are aligned, install hose clamps.

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Undercover Removal and Installation
- Crankshaft Pulley Removal and Installation
- Engine Mounting Insulator and Bracket Assembly Removal and Installation

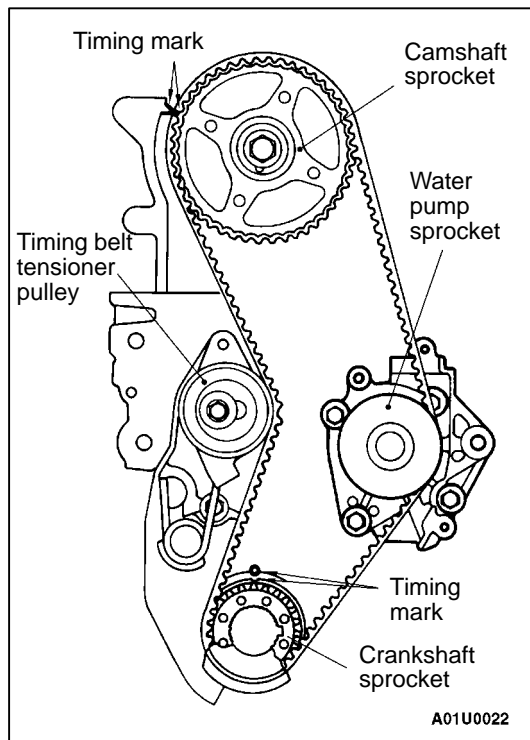


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Removal steps

1. Crank angle sensor connector
2. Timing belt front upper cover
3. Power steering hose clamp
4. Alternator brace
5. Timing belt front lower cover
6. Power steering oil pump bracket stay

7. Crankshaft sprocket flange
8. Engine support bracket
- Timing belt tension adjustment
9. Timing belt
10. Tensioner spring
11. Timing belt tensioner



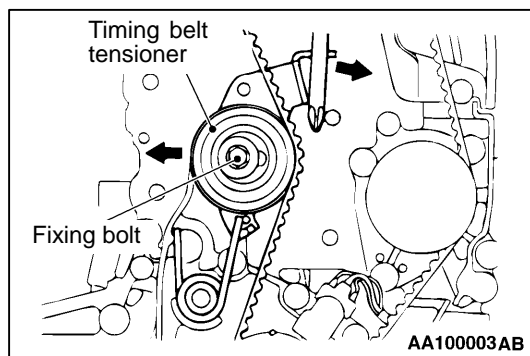
REMOVAL SERVICE POINT

◀▶ 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 center.

Caution

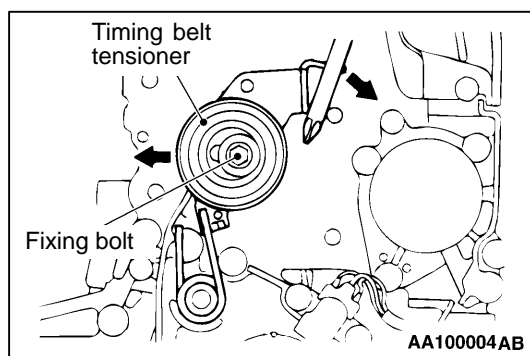
The crankshaft should always be turned only clockwise.



2. Loosen the fixing bolt.
3. Insert a screwdriver in the timing belt tensioner, and then release the tensioner towards the arrow direction.
4. Tighten the fixing bolt provisionally.
5. Remove the timing belt.

Caution

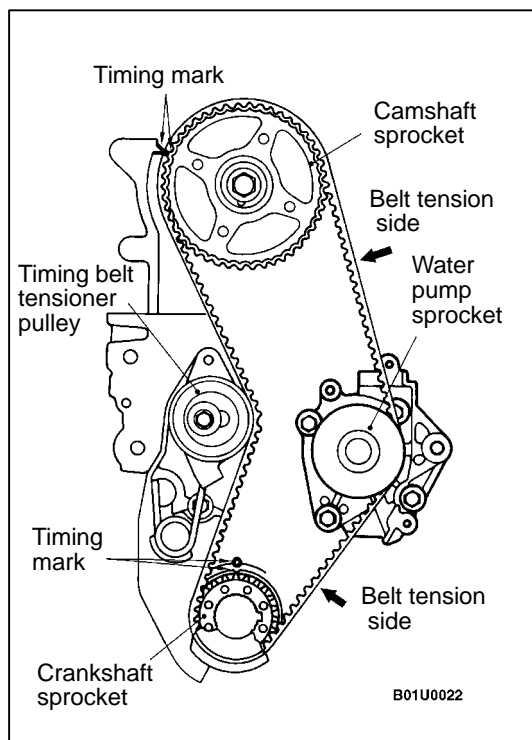
If the timing belt is to be re-used, use chalk to mark the flat side of the belt with an arrow indicating the direction of rotation (right turn).



INSTALLATION SERVICE POINTS

▶◀ TIMING BELT INSTALLATION

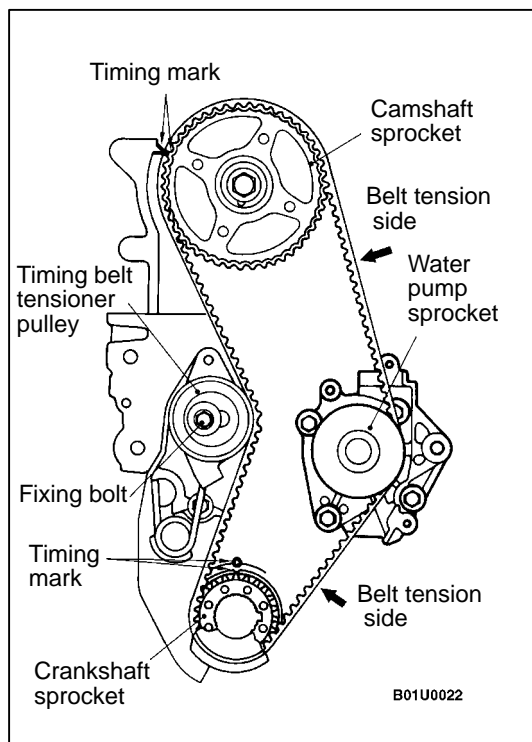
1. Loosen the fixing bolt, and engage a screwdriver to move the timing belt tensioner towards the intake port side fully. Tighten the fixing bolt temporarily to hold the tensioner at this position.



2. Align each of the camshaft sprocket and the crankshaft sprocket timing marks.
3. 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) Timing belt 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.

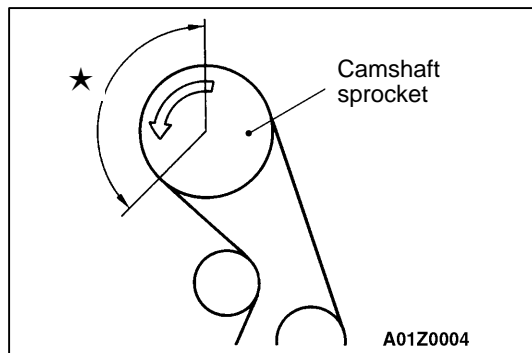


►B◄TIMING BELT TENSION ADJUSTMENT

1. Initially loosen the fixing bolt of the timing belt 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.

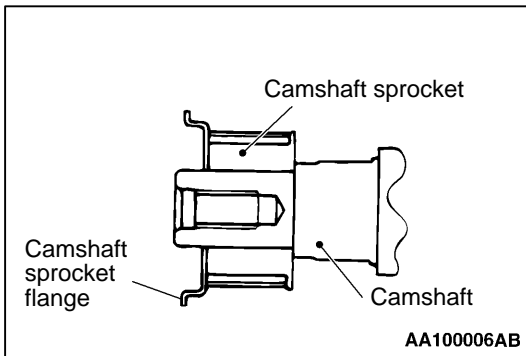
Caution

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 ★ are lifted up and that the teeth in each sprocket are engaged, secure the tensioner pulley.

Tightening torque: 23 ± 3 N·m



►◄ CRANKSHAFT SPROCKET FLANGE INSTALLATION

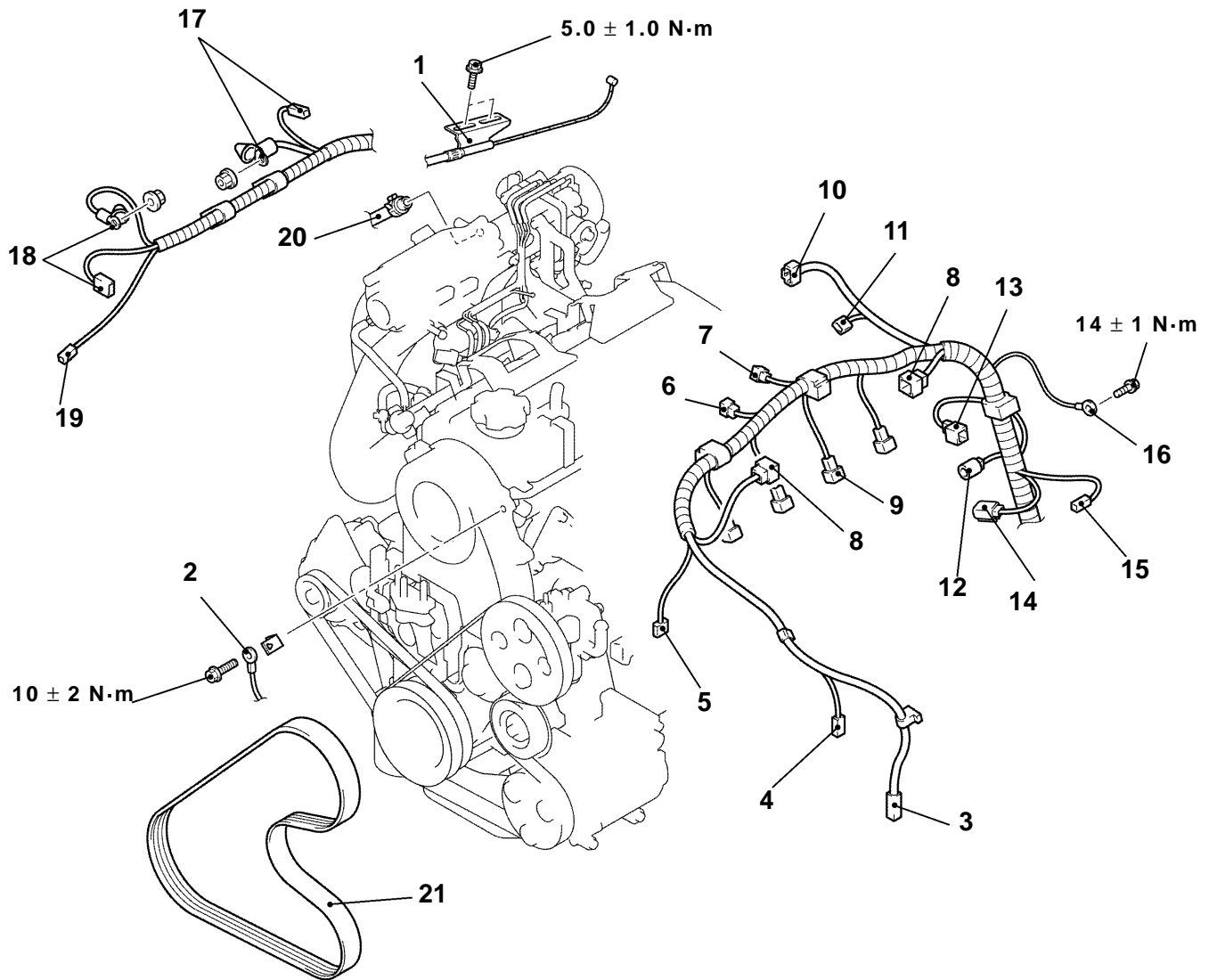
Install the crankshaft sprocket flange as shown in the illustration.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Fuel Discharge Prevention (Refer to GROUP 13F – On-vehicle Service.) <before removal only>
- Fuel Leak Check <after installation only>
- Accelerator Cable Adjustment (Refer to [On-vehicle Service.](#)) <after installation only>
- Under Cover Removal and Installation
- Hood Removal and Installation
- [Drive Belt Tension Adjustment](#) <only after installation>
- Engine Oil Draining and Supplying
- Engine Coolant Draining and Supplying (Refer to [On-vehicle Service.](#))
- [Air Cleaner Removal and Installation](#)
- Battery and Battery Tray Removal and Installation
- [Radiator Removal and installation](#)
- [Front Exhaust Pipe Removal and Installation](#)



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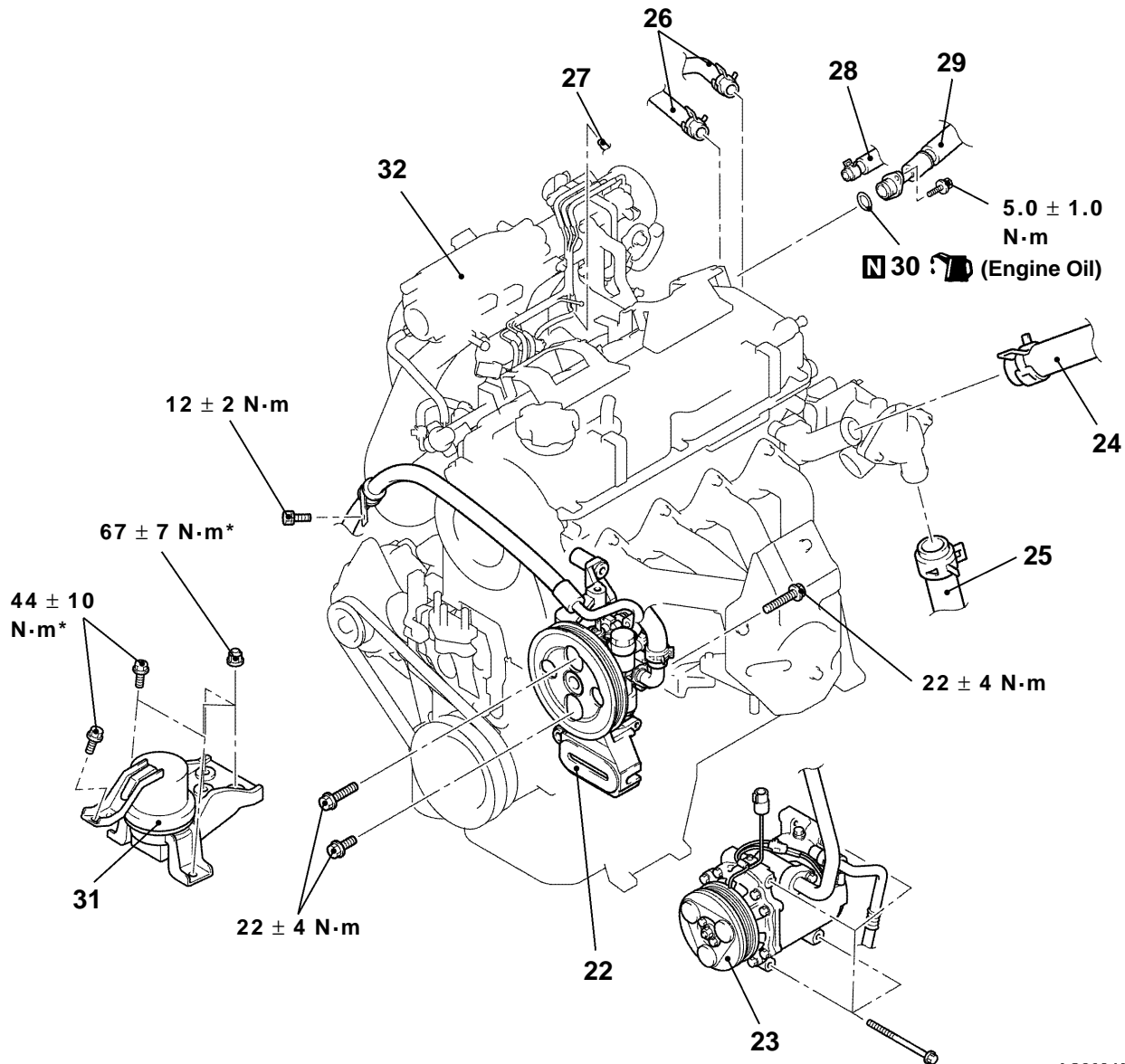
Removal steps

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



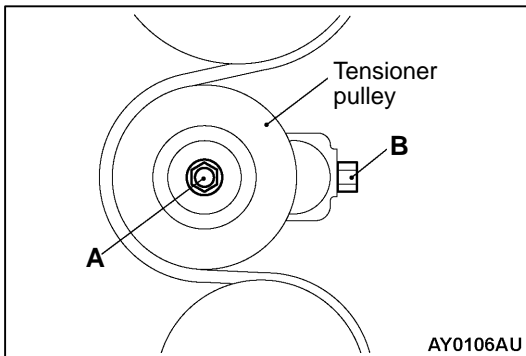
Caution

Tightening sections indicated in the mark (*) should be finally tightened with engine weight applied on the body after lightly tightening.



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| ◀B▶ | 22. Power steering oil pump and brace assembly | ▶C▶ | 29. Fuel high pressure hose connection |
| ▶C▶ | 23. A/C compressor | ▶C▶ | 30. O-ring |
| ▶D▶ | 24. Radiator upper hose connection | • | Transmission assembly |
| ▶D▶ | 25. Radiator lower hose connection | | (M/T) |
| | • Radiator assembly | | (A/T) |
| | 26. Heater hose connection | ◀E▶ | ▶B▶ |
| | 27. Purge hose connection | | 31. Engine mounting insulator and bracket assembly |
| | 28. Fuel return hose connection | ▶A▶ | 32. Engine assembly |



REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND A/C COMPRESSOR DRIVE BELT REMOVAL

1. Loosen the tensioner pulley locking nut A of tensioner pulley.
2. Rotate adjusting bolt B anti-clockwise (in left turn), and remove drive belt.

◀B▶ POWER STEERING OIL PUMP AND BRACE ASSEMBLY REMOVAL

Remove power steering oil pump and brace assembly from engine with hose connected.

NOTE

Removed power steering oil pump and brace assembly should be bound together with a cord for prevention of damage in the event of removing and installing engine assembly.

◀C▶ A/C COMPRESSOR REMOVAL

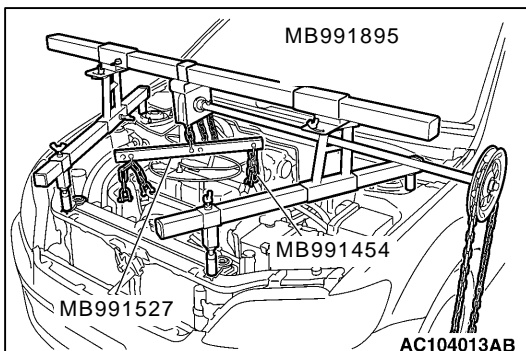
Remove A/C compressor from bracket with hose connected.

NOTE

Removed A/C compressor should be bound together with a cord for prevention of damage in the event of removing and installing engine assembly.

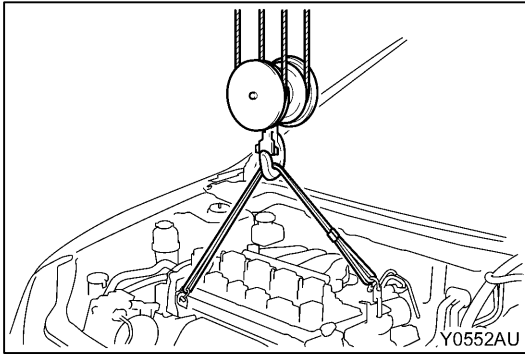
◀D▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE REMOVAL

After alignment marks are indicated on radiator hoses and hose clamps, remove hoses.



◀E▶ ENGINE MOUNTING INSULATOR AND BRACKET ASSEMBLY REMOVAL

1. Support engine with garage jack.
2. Remove special tool. (Tool which was installed in the event of removing transmission assembly)



3. Retain engine assembly with chain block, etc.
4. Place garage jack at the engine oil pan through the 4X4 wood cut. Remove engine mounting insulator and bracket assembly with engine weight not applied on engine mounting insulator and bracket assembly.

MAIN

Group
11

11A

INSTALLATION SERVICE POINTS

►A◄ ENGINE ASSEMBLY INSTALLATION

By checking for engagement of cables, hoses, and harness connectors, mount engine assembly.

►B◄ ENGINE MOUNTING INSULATOR AND BRACKET ASSEMBLY INSTALLATION

1. Place garage jack at the engine oil pan through the 4X4 wood cut. By adjusting engine position, install engine mounting insulator and bracket assembly.
2. Support engine with garage jack.
3. Remove chain block and retain engine assembly with special tool. (Tool which was installed in the event of removing transmission assembly)

►C◄ O-RING/FUEL HIGH PRESSURE HOSE INSTALLATION

1. Apply small quantity of new engine oil on O-ring.

Caution

Care should be taken for prevention of engine oil from flowing into fuel pump (high pressure).

2. Install fuel pump (high pressure) by swinging fuel high pressure hose left and right to prevent damage of O-ring. After that, ensure that the pump is rotated smoothly.
3. When the pump is not rotated smoothly, O-ring may be engaged. Remove fuel high pressure hose and check for damage on O-ring. Insert the hose into fuel pump (high pressure) and check for proper rotation again.
4. Tighten mounting bolts of fuel high pressure hose to the specified torque.

Tightening torque: 5.0 ± 1.0 N·m

►D◄ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE INSTALLATION

1. Insert hose up to the convex of water inlet fitting and water outlet fitting.
2. With alignment marks on radiator hose and hose clamps are aligned, install hose clamps.