ENGINE

CONTENTS

11109000276

ENGINE <4G6>

CONTENTS

11109000603

GENERAL INFORMATION

11100010469

Items			4G63
Total displacement mL			1,997
Bore × Stroke mm			85.0 ×88.0
Compression ratio			10.0
Combustion chamber			Pentroof type
Camshaft arrangement			SOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 11°
		Closing	ABDC 53°
	Exhaust	Opening	BBDC 63°
		Closing	ATDC 21°
Fuel system			Electronically controlled multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

11100030489

Items			Standard value	Limit
Alternator drive belt tension	Tension N	When checked	294 - 490	-
		When a used belt is installed	343 - 441	-
		When a new belt is installed	490 - 686	-
	Deflection (Reference value) mm	When checked	7.7 - 12.3	-
		When a used belt is installed	8.4 - 10.6	-
		When a new belt is installed	5.9 - 7.7	-
Power steering oil pump and A/C compressor drive belt tension	Tension N	When checked	392 - 588	-
		When a used belt is installed	441 - 539	-
		When a new belt is installed	637 - 833	-
	Deflection mm	When checked	11.7 - 15.3	-
		When a used belt is installed	12.5 - 14.3	-
		When a new belt is installed	8.8 - 11.0	-
Basic ignition timing			5° BTDC±2°	-
Ignition timing			Approx. 10°BTDC	-

Items	Standard value	Limit
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	1,400	Min. 1,060
Compression pressure difference of all cylinder kPa	-	Max. 100
Intake manifold vacuum kPa	-	Min. 69
Cylinder head bolt shank length mm	-	99.4
Auto-tensioner push rod movement mm	Within 1	-
Timing belt tension torque Nm (Reference value)	3.5	-
Auto-tensioner rod protrusion amount mm	3.8 - 4.5	-
Timing belt B tension mm	5 - 7	-

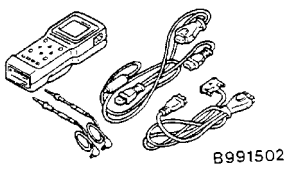
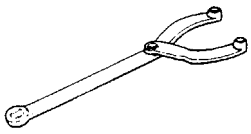
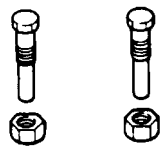
SEALANTS

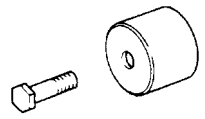
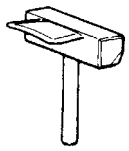
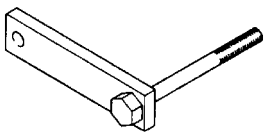
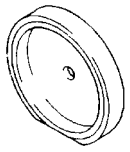
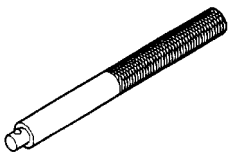
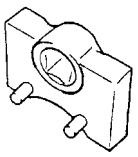
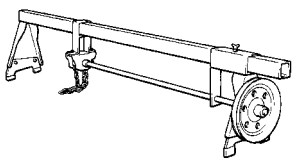
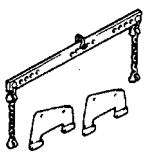
11100050201

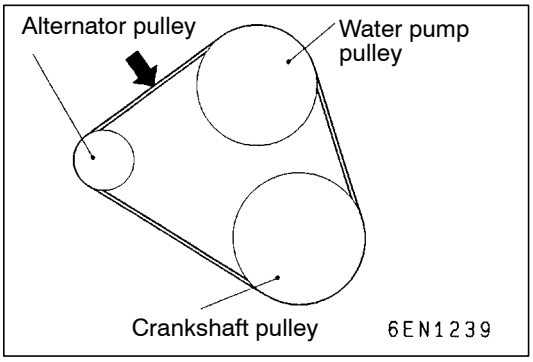
Items	Specified sealants	Remarks
Rocker cover and cylinder head Semi-circular packing	3M ATD Part No.8660 or equivalent	-
Oil pan Thermostat case	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Flywheel bolt	3M Stud Locking 4170 or equivalent	-

SPECIAL TOOLS

11100060457

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	● Checking the idle speed ● Erasing diagnosis code
	MB990767	End yoke holder	● Holding the camshaft sprocket ● Holding the crankshaft sprocket
	MD998719 or MD998754	Crankshaft pulley holder pin	● Holding the camshaft sprocket ● Holding the crankshaft sprocket

Tool	Number	Name	Use
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
	MD998443	Auto-lash adjuster holder	Supporting of auto-lash adjuster
	MD998727	Oil pan remover	Removal of oil pan
	MD998781	Flywheel stopper	Securing the flywheel
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	Press-in of the crankshaft rear oil seal
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
 B991453	MB991453	Engine hanger assembly	



ON-VEHICLE SERVICE

11100090432

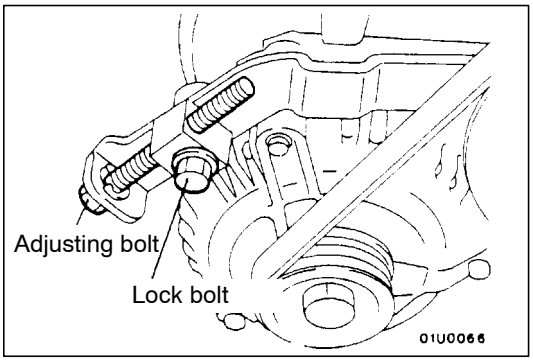
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

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

Standard value:

Tension N	294 - 490
Deflection (Reference value) mm	7.7 - 12.3



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

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

   Standard value:

Items	When a used belt is installed	When a new belt is installed
Tension N	343 - 441	490 - 686
Deflection (Reference value) mm	8.4 - 10.6	5.9 - 7.7

4. Tighten the nut of the alternator pivot bolt.

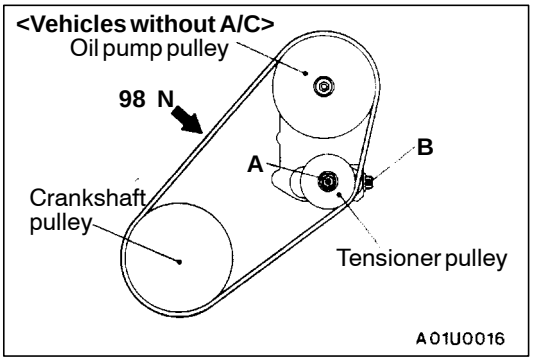
   Tightening torque: 44 Nm

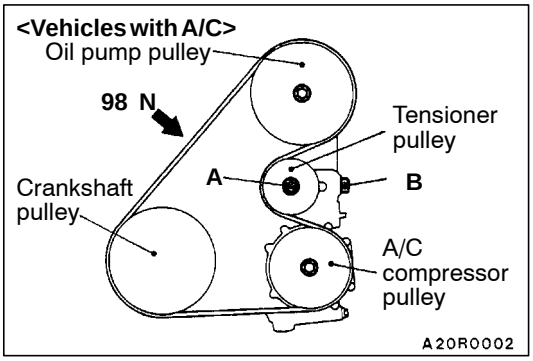
5. Tighten the lock bolt.

   Tightening torque: 22 Nm

6. Tighten the adjusting bolt.

   Tightening torque: 10 Nm





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

11100130127

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

   Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Tension N	392 - 588	441 - 539	637 - 833
Deflection (Reference value) mm	11.7 - 15.3	12.5 - 14.3	8.8 - 11.0

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

   Tightening torque: 25 Nm

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

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

IGNITION TIMING CHECK

11100170297

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

   Standard value: 750 ± 100 r/min

6. Select No.17 of the MUT-II Actuator test.

7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC±2°

8. If the basic ignition timing is outside the standard value, inspect the MPI system while referring to GROUP 13A - Troubleshooting.
9. Press the MUT-II clear key (Select a forced driving cancel mode) to release the Actuator test.

   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. 10°BTDC

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

IDLE SPEED CHECK

11100350066

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

   Standard value: 5° BTDC±2°

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

   Standard value: 750 ± 100 r/min

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

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

IDLE MIXTURE CHECK

11100210418

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

   Standard value: 5° BTDC±2°

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

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

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

7. If there is a deviation from the standard value, check the following items:
   - Diagnosis output
   - Closed-loop control (When the closed-loop control is normal, the output signal of the oxygen sensor changes between 0 - 400 mV and 600 - 1,000 mV at idle.)
   - 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.

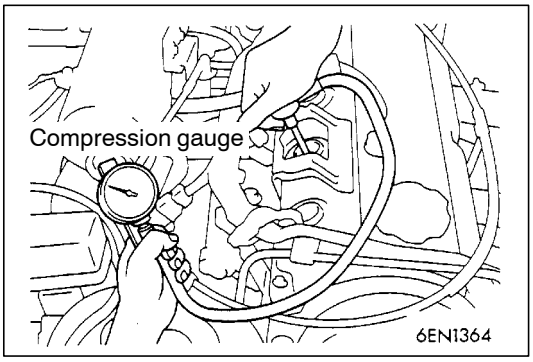
COMPRESSION PRESSURE CHECK 11100260499

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

   NOTE
   Doing this will prevent the engine-ECU from carrying out ignition and fuel injection.

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

   Caution
   1. Keep away from the spark plug hole when cranking.
   2. If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.



6. Set compression gauge to one of the spark plug holes.
7. Crank the engine with the throttle valve fully open and measure the compression pressure.

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

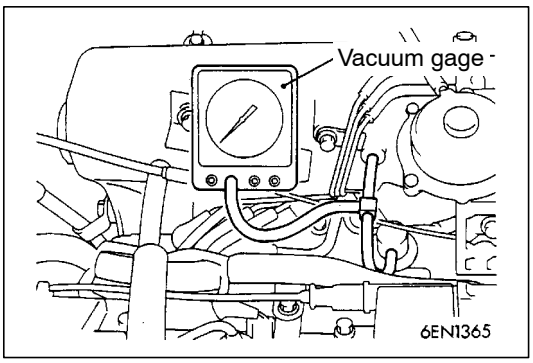
   Limit (at engine speed of 250 - 400 r/min): Min. 1,060 kPa

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

   Limit: Max. 100 kPa

9. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps 7 and 8.
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
10. Connect the crank angle sensor connector.
11. Install the spark plugs and spark plug cables.
12. Use the MUT-II to erase the diagnosis codes.

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



MANIFOLD VACUUM CHECK

11100270409

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 standard value. Then read off the vacuum gauge.

   Limit: Min. 69 kPa

LASH ADJUSTER CHECK

11100290344

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 y the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N → D).
If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings. (In such cases, the lash adjusters are normal.)
4. After the engine has warmed up, run it at idle and check if any noise can be heard.
If the noise has become smaller or has disappeared, the cause of the noise was probably that oil sludge had caused the lash adjusters to become stuck. If this happens, carry out the following check. If the noise level does not change, go to step 5.
(1) Let the engine cool down sufficiently.
(2) Turn the crankshaft two full revolutions.

(3) Carry out lash adjuster simple check. (Refer to P.11A-13.)
- If any of the rocker arms can be pushed down easily during the lash adjuster simple check, replace the corresponding lash adjusters.
- If the lash adjuster simple check has been carried out but all lash adjusters are normal (if none of the rocker arms could be pushed down easily), check for some other cause of the problem.

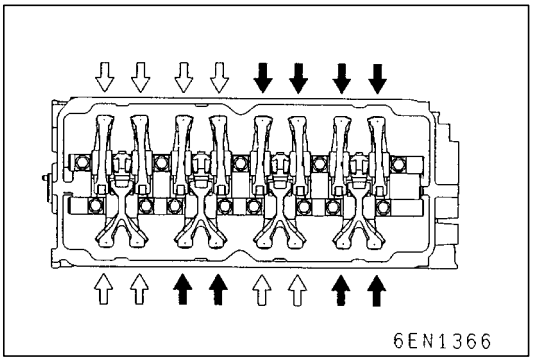
NOTE
You can check whether the lash adjusters are normal or not by carrying out a leak-down test. (Refer to the Engine Workshop Manual.)

Caution
Make sure that the air has been fully bled before installation of a new lash adjuster. (Refer to the Engine Workshop Manual.)

5. Bleed the air from the lash adjusters. (Refer to P.11A-13.)
6. If the noise does not disappear even after the air has been bled from the lash adjusters, carry out the following check.
   Carry out lash adjuster simple check. (Refer to P.11A-13.)
   - If one of the rocker arms can be pushed down easily during the lash adjuster simple check, replace the corresponding lash adjuster.
   - If two or more of the rocker arms can be pushed down easily during the lash adjuster simple check, the cause may be that the oil passage to the cylinder head is blocked.
     Check for blockages in the oil passage, and clear the blockages if any are found. If there are no blockages, replace the lash adjusters.
   - If the lash adjuster simple check has been carried out but all lash adjusters are normal (if none of the rocker arms could be pushed down easily), check for some other cause of the problem.

   NOTE
   You can check whether the lash adjusters are normal or not by carrying out a leak-down test. (Refer to the Engine Workshop Manual.)

   Caution
   Make sure that the air has been fully bled before installation of a new lash adjuster. (Refer to the Engine Workshop Manual.)
7. Start the engine and check that the abnormal noise has disappeared. If necessary, bleed the air from the lash adjusters. (Refer to P.11A-13.)



<LASH ADJUSTER SIMPLE CHECK>

1. Stop the engine.
2. Remove the rocker cover.
3. Set the No.1 cylinder to the compression top dead centre position.
4. Check the rocker arms indicated by white arrows in the illustration by the procedures given below.

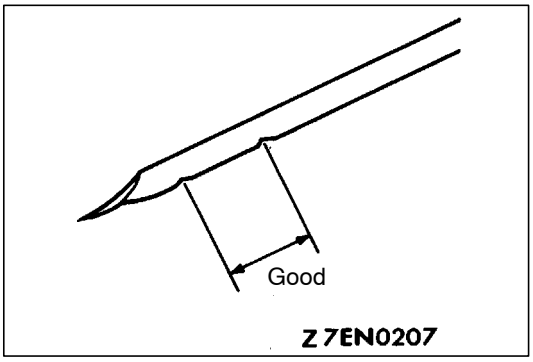
   <Checking an intake-side rocker arm>
   Check whether the rocker arm moves downwards when the part of the rocker arm which touches the top of the lash adjuster is pushed.
   - If the rocker arm moves down easily when it is pushed, make a note of which is the corresponding lash adjuster.
   - If the rocker arm feels extremely stiff when it is pushed and does not move down, the lash adjuster is normal, so check for some other cause of the problem.

   <Checking an exhaust-side rocker arm>

   NOTE
   It will not be possible to depress the Y-shaped rocker arm at the exhaust valve side if one lash adjuster is defective but the other one is normal. In such cases, carry out the following procedure using a thickness gauge.
   (1) Check that a thickness gauge with a thickness of 0.1 - 0.2 mm can be inserted easily between the valve and the lash adjuster.
   (2) If the thickness gauge can be inserted easily, make a note of which is the corresponding lash adjuster.
   (3) If the thickness gauge cannot be inserted easily, the lash adjuster is normal, so check for some other cause of the problem.
5. Slowly turn the crankshaft 360° in the clockwise direction.
6. Check the rocker arms indicated by black arrows in the illustration in the same way as explained in step 4.

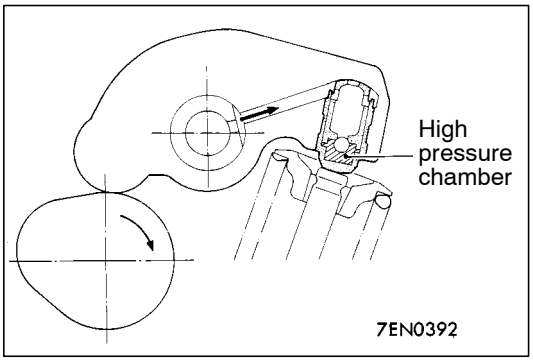
<LASH ADJUSTER AIR BLEEDING>

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.

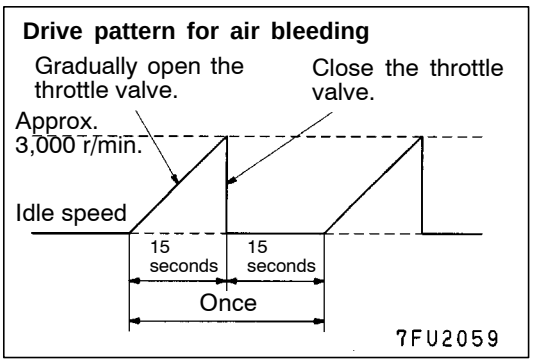


1. Check the engine oil and replenish or replace the oil if necessary.

   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.

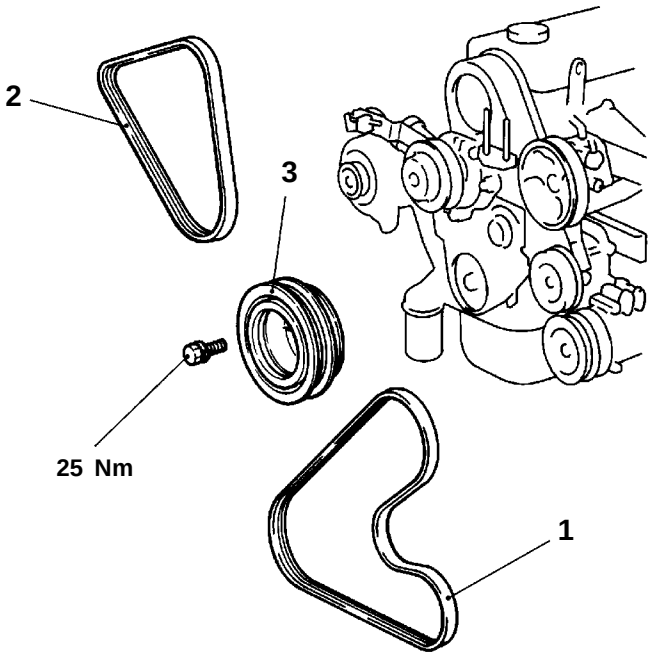
CRANKSHAFT PULLEY

11200160303

REMOVAL AND INSTALLATION

Pre-removal Operation
- Under Cover Removal

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



A01I0077

Removal steps

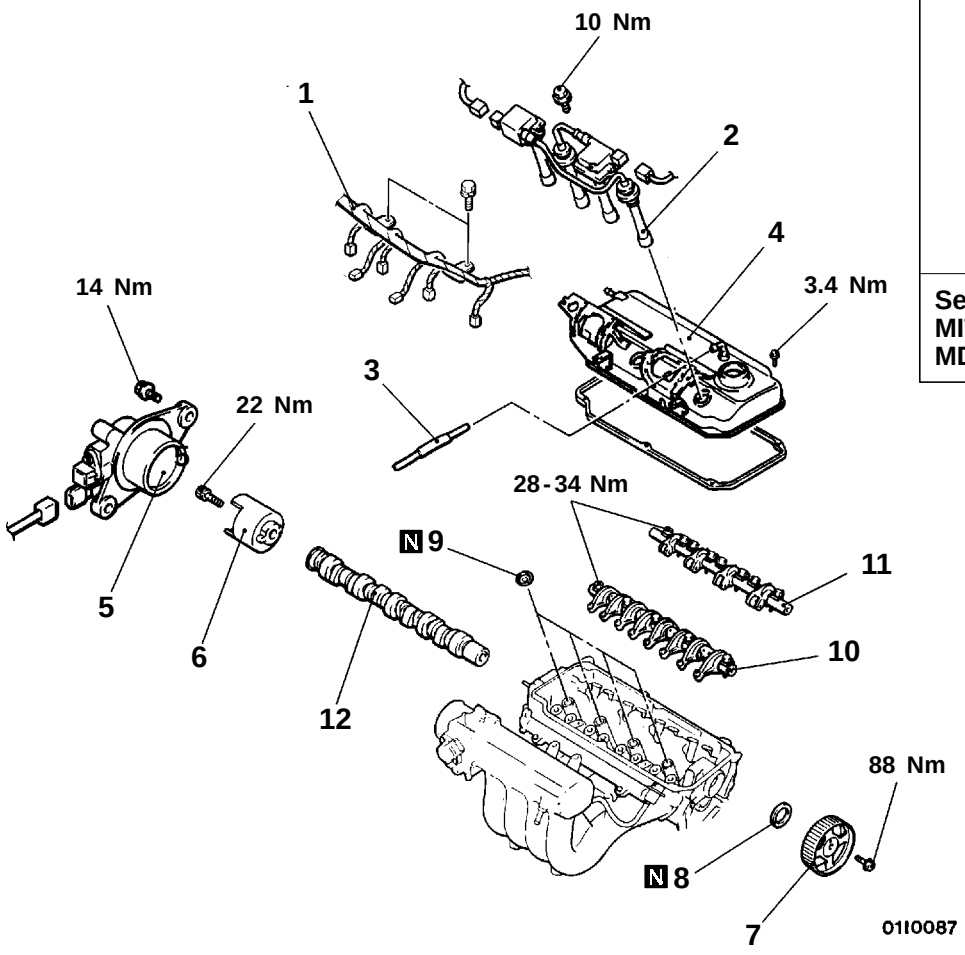
1. Drive belt (Power steering and A/C)
2. Drive belt (Alternator)
3. Crankshaft pulley

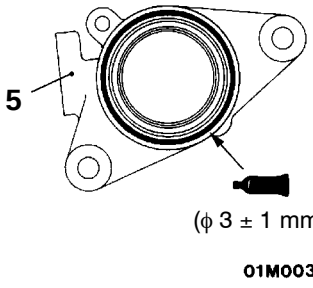
CAMSHAFT AND CAMSHAFT OIL SEAL

11200190418

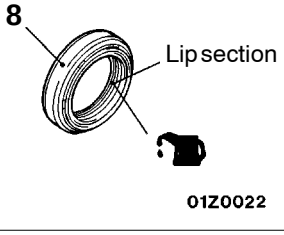
REMOVAL AND INSTALLATION

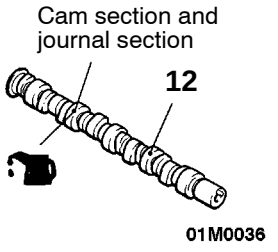
Pre-removal and Post-installation Operation
- Air Cleaner Removal and Installation
- Timing Belt Removal and Installation (Refer to P.11A-26.)
- Relay Box Removal and Installation





Sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent





Engine oil

00006480

Removal steps

1. Control harness connection
2. Spark plug cable
3. PCV hose connection
4. Rocker cover
5. Camshaft position sensor support
6. Camshaft position sensing cylinder

◀A▶ ▶C◀ 7. Camshaft sprocket

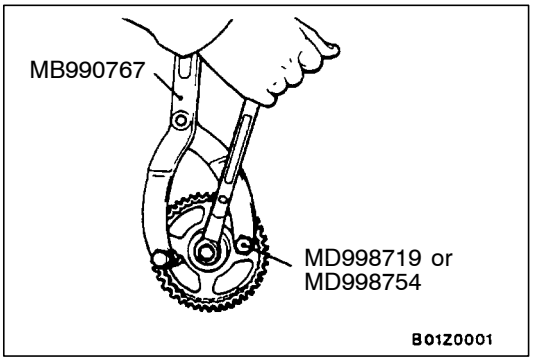
▶B◀ 8. Camshaft oil seal

9. Spark plug guide oil seal

◀B▶ ▶A◀ 10. Rocker arm and shaft assembly (intake side)

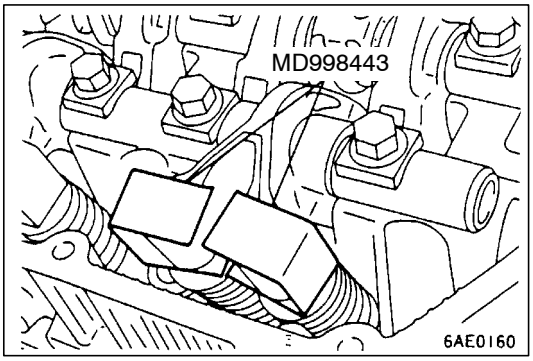
◀B▶ ▶A◀ 11. Rocker arm and shaft assembly (exhaust side)

12. Camshaft



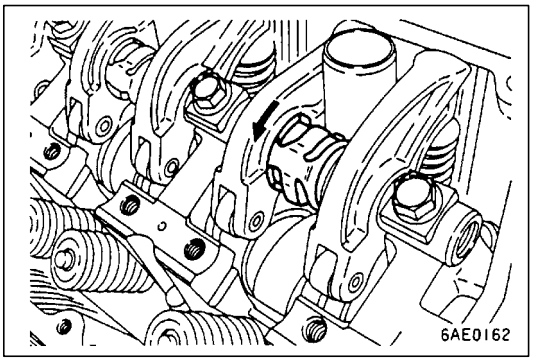
REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL



◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

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

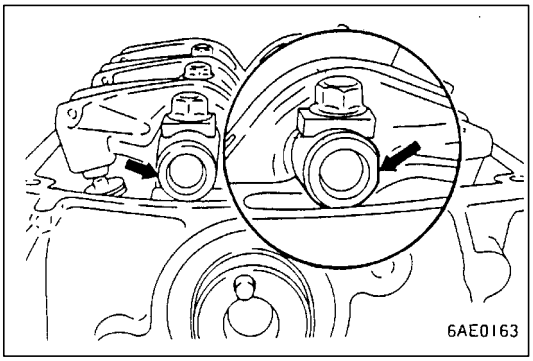


INSTALLATION SERVICE POINTS

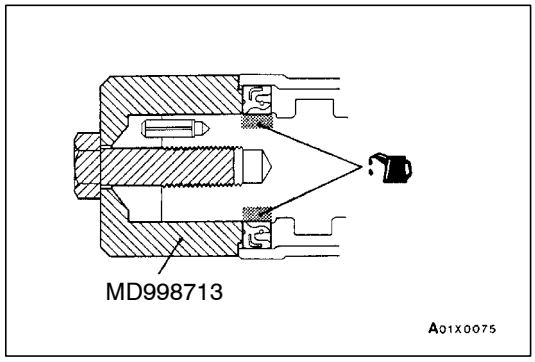
▶A◀ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. Temporarily tighten the rocker shaft with the bolt so that all rocker arms on the inlet valve side do not push the valves.
2. Fit the rocker shaft spring from the above and position it so that it is right angles to the plug guide.

   NOTE
   Install the rocker shaft spring before installing the rocker arm and rocker arm shaft on the exhaust side.
3. Remove the special tool for fixing the lash adjuster.



4. Confirm that the rocker shaft notch is in the direction shown in the diagram.



▶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.

▶C◀ CAMSHAFT SPROCKET INSTALLATION

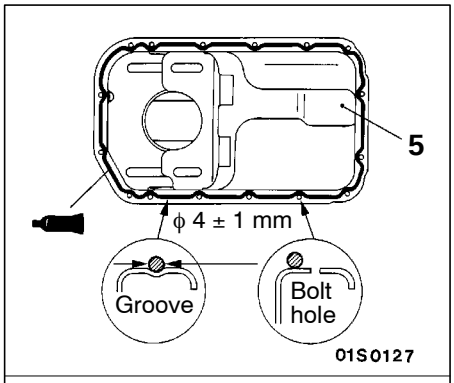
Use the special tool to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

OIL PAN

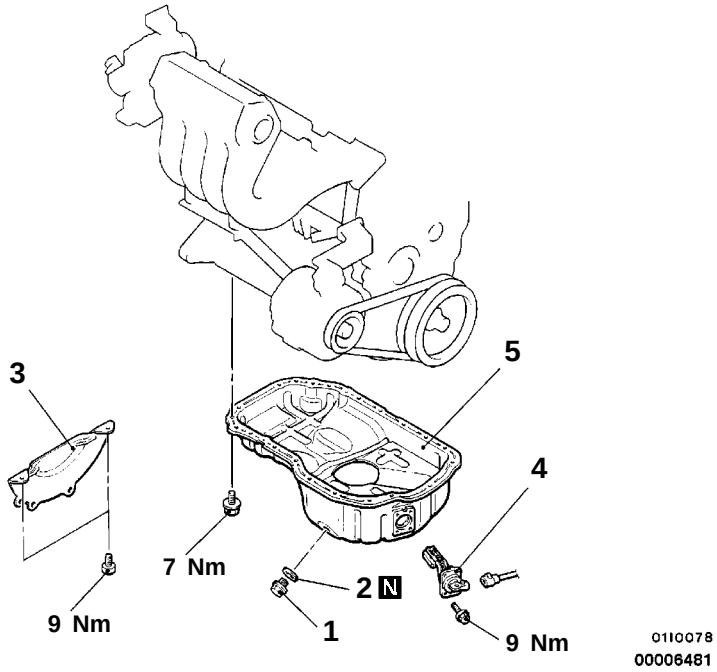
11200280207

REMOVAL AND INSTALLATION

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

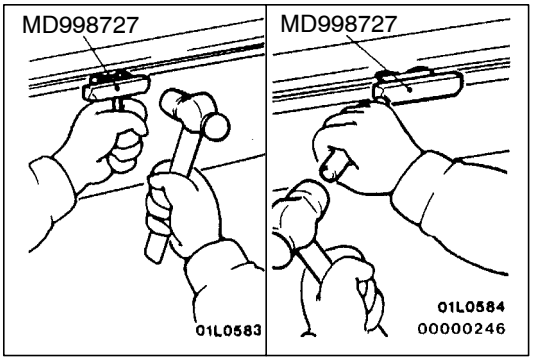


Sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent



Removal steps

1. Drain plug
▶A◀ 2. Drain plug gasket
3. Bell housing cover
4. Oil level sensor
◀A▶ 5. Oil pan

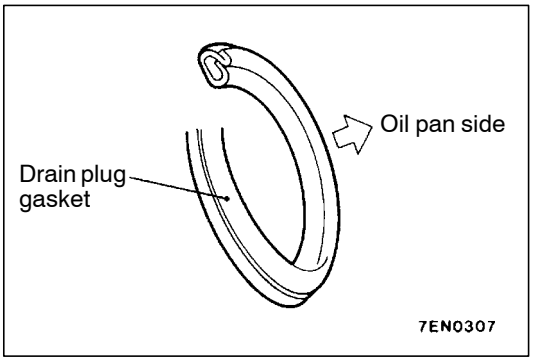


REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

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

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



INSTALLATION SERVICE POINT

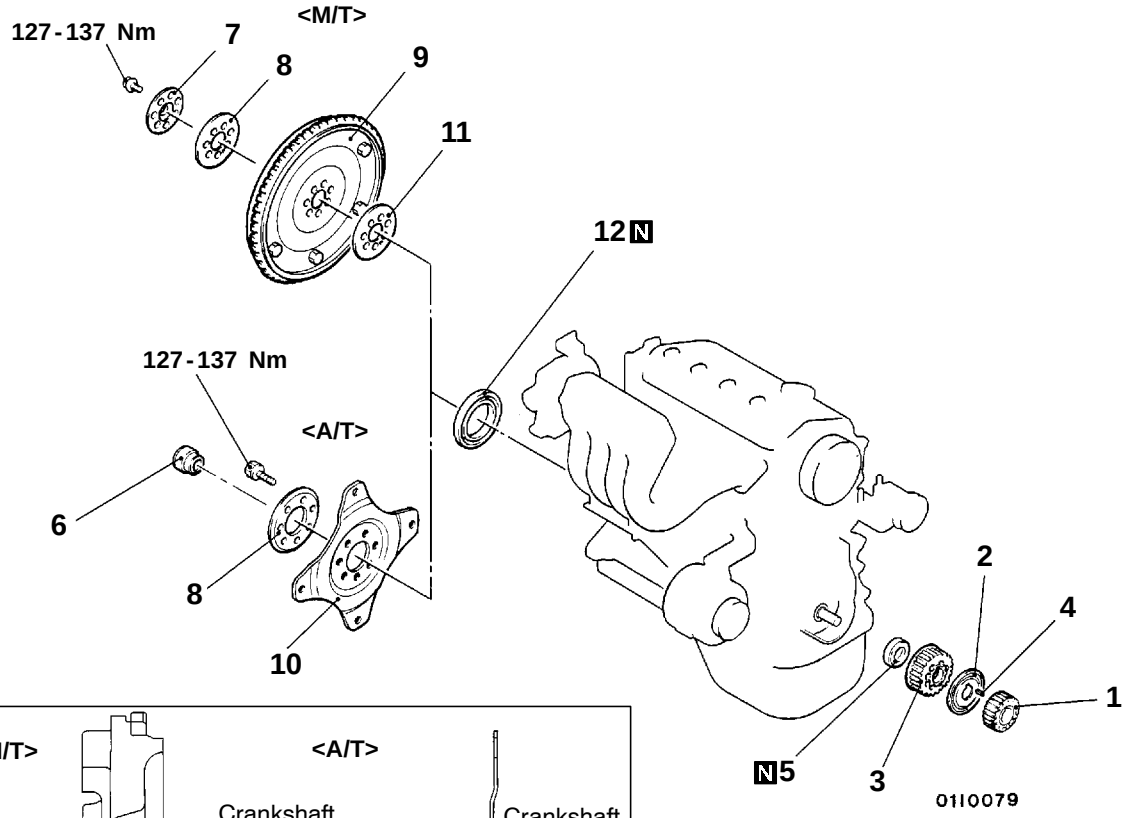
▶A◀ DRAIN PLUG GASKET INSTALLATION

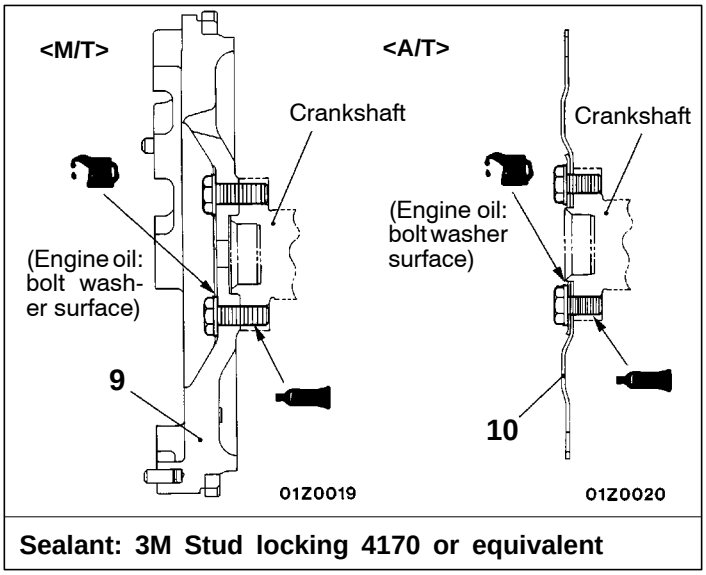
Install the drain plug gasket in the direction so that it faces as shown in the illustration.

CRANKSHAFT OIL SEAL

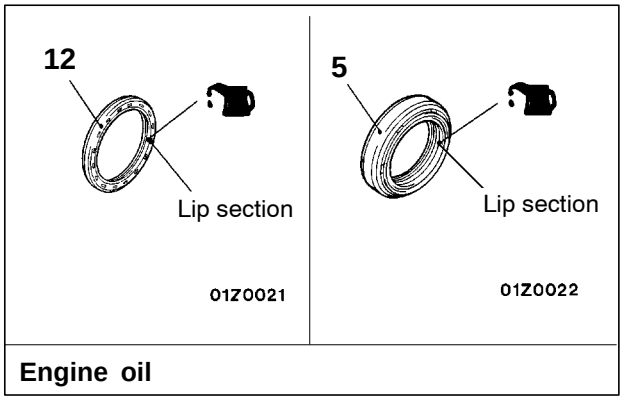
11200310135

REMOVAL AND INSTALLATION





Sealant: 3M Stud locking 4170 or equivalent



Engine oil

00006482

Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11A-26.)
- Crank angle sensor (Refer to GROUP 16.)

1. Crankshaft sprocket
2. Flange
3. Crankshaft sprocket B
4. Key

▶C◀ 5. Crankshaft front oil seal

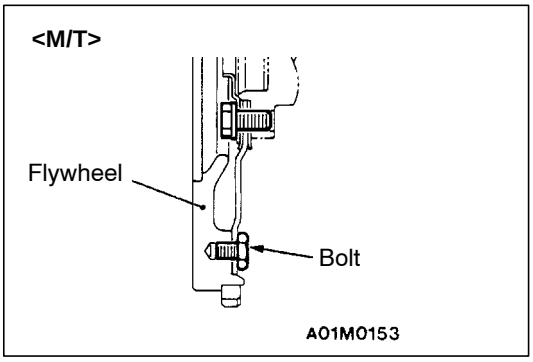
◀A▶
- Oil pan (Refer to P.11A-19.)
- Transmission assembly
- Clutch cover and disc <M/T>

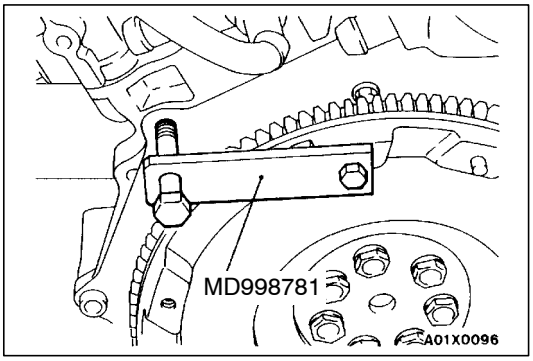
6. Crankshaft bushing

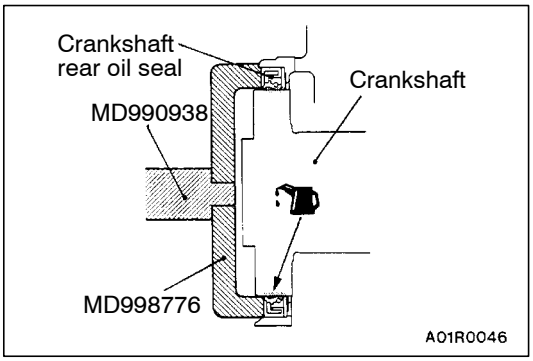
◀B▶ ▶B◀ 7. Plate <M/T>
◀B▶ ▶B◀ 8. Adapter plate
◀B▶ ▶B◀ 9. Flywheel <M/T>
◀B▶ ▶B◀ 10. Drive plate <A/T>
◀B▶ ▶B◀ 11. Adapter plate <M/T>

Crankshaft rear oil seal removal steps

▶A◀ 12. Crankshaft rear oil seal







REMOVAL SERVICE POINTS

◀A▶ TRANSMISSION ASSEMBLY REMOVAL

<M/T>:
Refer to GROUP 22.

Caution
Do not remove the flywheel mounting bolt shown by the arrow. If this bolt Is removed, the flywheel will become out of balance and damaged.

<A/T>:
Refer to GROUP 23.

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

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

INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

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

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

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

   Specified sealant: 3M Stud locking 4170 or equivalent

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

▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

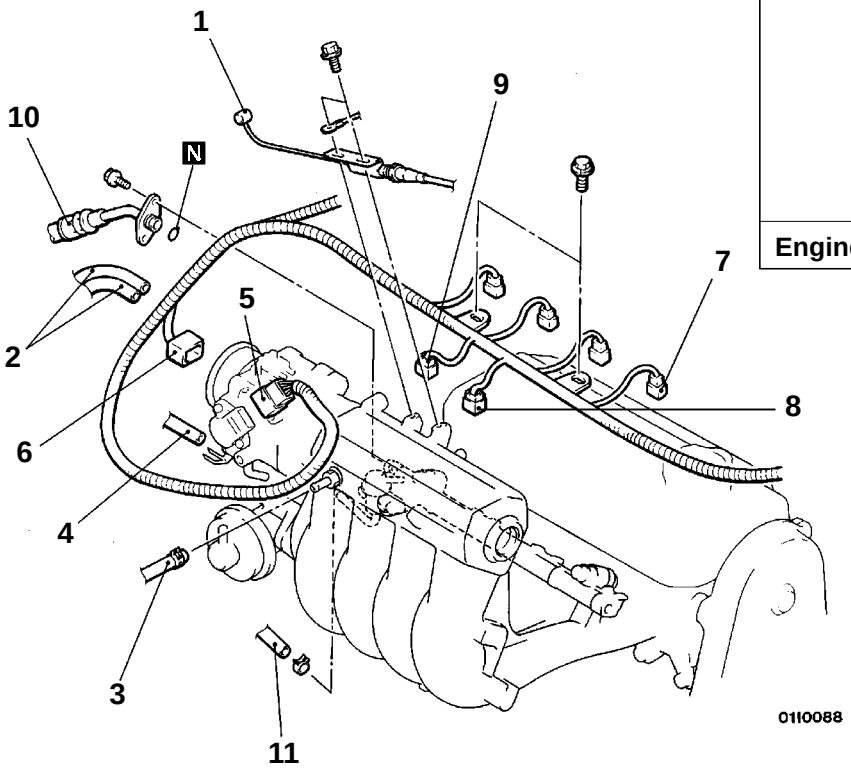
CYLINDER HEAD GASKET

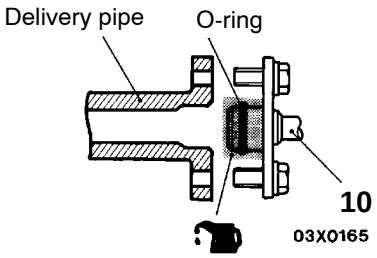
11200400542

REMOVAL AND INSTALLATION

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

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



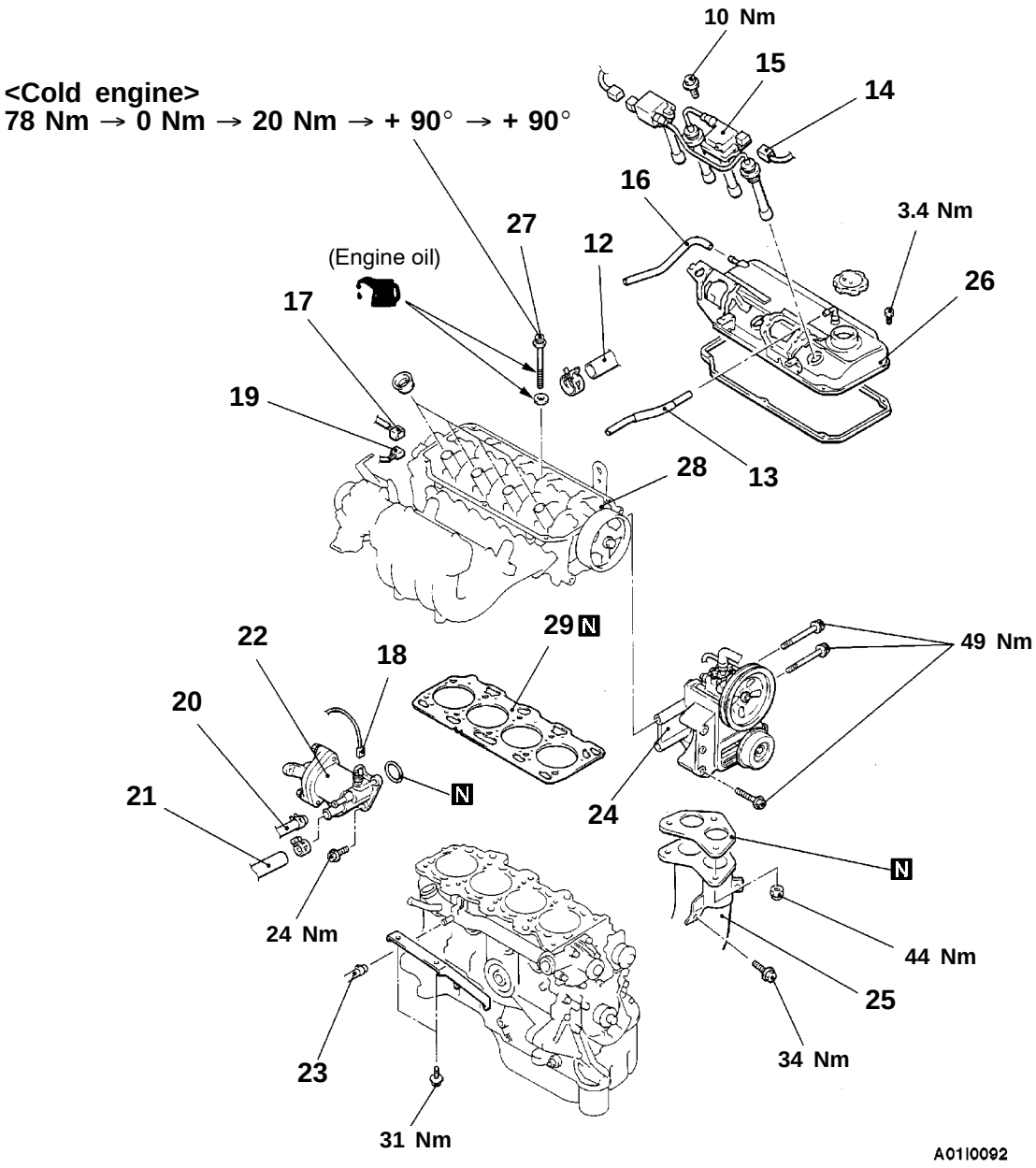


Engine oil

00006483

Removal steps

1. Accelerator cable connection
2. Vacuum hose connection
3. Brake booster vacuum hose connection
4. Vacuum hose connection
5. Throttle position sensor connector
6. Idle speed control connector
7. Injector connector
8. Purge control solenoid valve connector
9. EGR solenoid valve connector
▶C◀ 10. High-pressure fuel hose connection
11. Fuel return hose connection



12. Radiator upper hose connection
13. PCV hose
14. Ignition coil connector
15. Ignition coil assembly
16. Breather hose
17. Engine coolant temperature sensor connector
18. Engine coolant temperature gauge unit connector
19. Camshaft position sensor
20. Water hose connection
21. Heater hose connection
22. Thermostat case assembly
23. Water hose connection
24. Power steering oil pump and bracket assembly
25. Front exhaust pipe connection
26. Rocker cover
    - Timing belt (Refer to P.11A-26.)
27. Cylinder head bolt
28. Cylinder head assembly
29. Cylinder head gasket

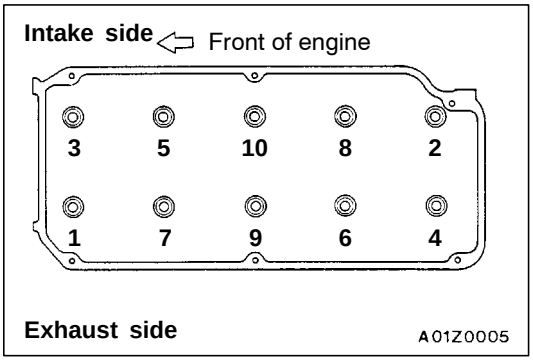
◀A▶ ◀B▶ ▶B◀ ▶A◀

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

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

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



◀B▶ CYLINDER HEAD BOLT REMOVAL

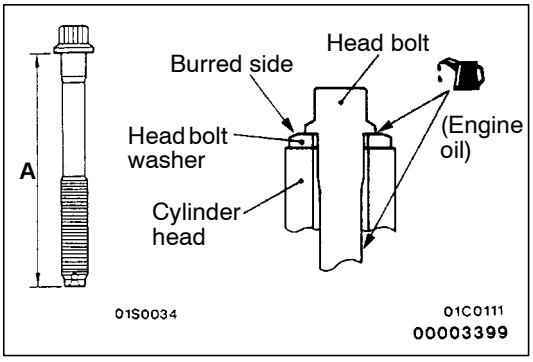
Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head assembly.

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

INSTALLATION SERVICE POINTS

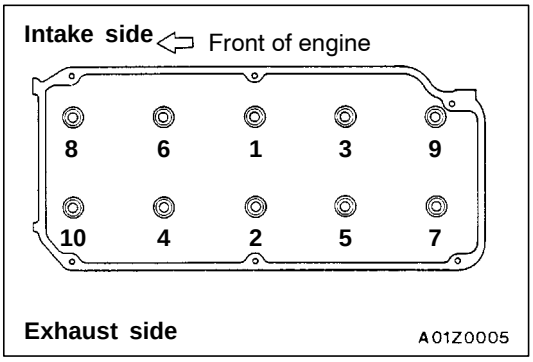
▶A◀ CYLINDER HEAD GASKET INSTALLATION

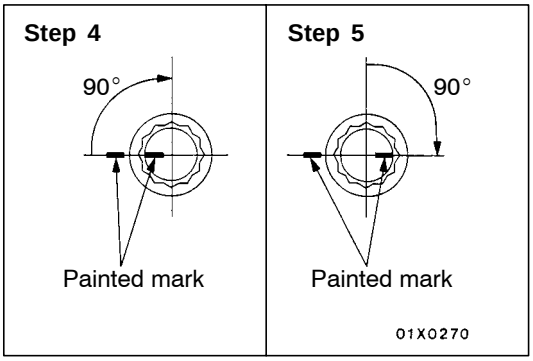
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.



▶B◀ CYLINDER HEAD BOLT INSTALLATION

1. When installing the cylinder head bolts, the length below the head of the bolts should be within the limit.
   If it is outside the limit, replace the bolts.
   Limit (A): 99.4 mm
2. The head bolt washer should be installed with the burred side caused by tapping out facing upwards.
3. Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.





4. Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 78 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.

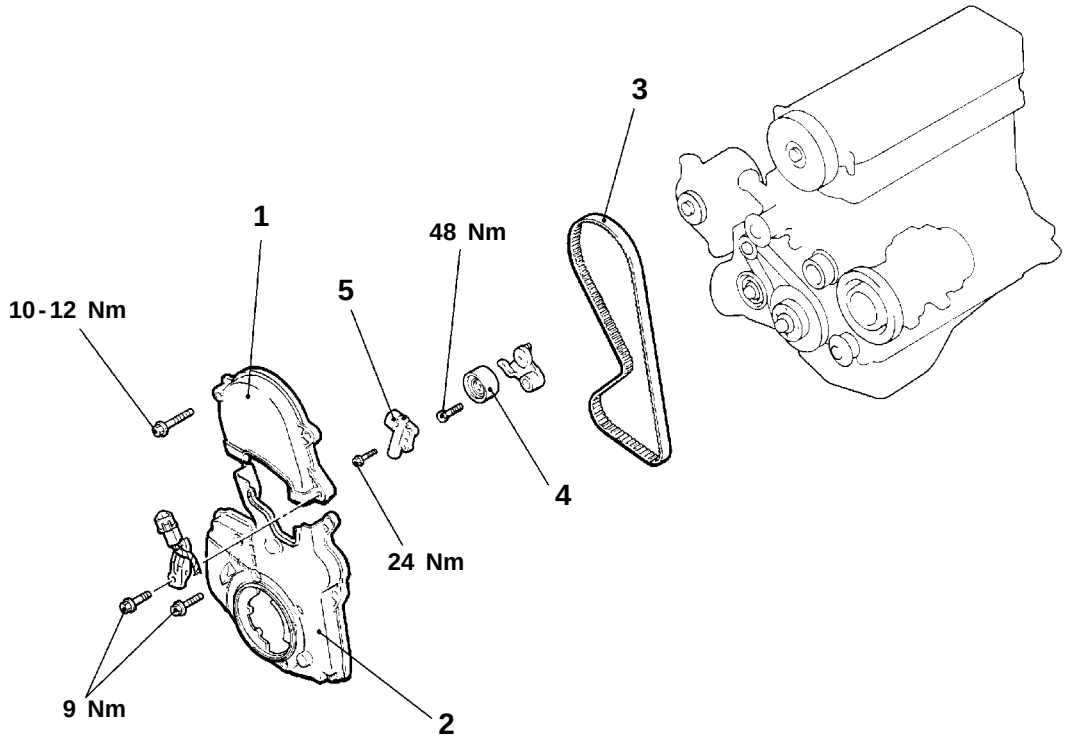
   Caution
   Do not let any engine oil get into the delivery pipe.
2. While turning the high-pressure fuel hose to the right and left, install the delivery pipe, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the 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

11200430473

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Crankshaft Pulley Removal and Installation (Refer to P.11A-15.)
- Engine Mount Bracket Removal and Installation (Refer to GROUP 32 - Engine Mounting.)



A01I0084

Removal steps

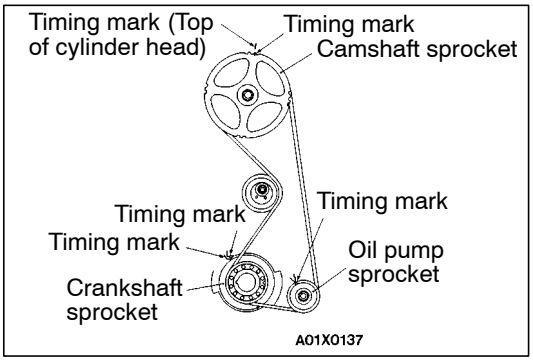
1. Timing belt upper cover
2. Timing belt lower cover

▶C◀ ● Timing belt tension adjustment

◀A▶ ▶B◀ 3. Timing belt

4. Tension pulley

▶A◀ 5. Auto tensioner

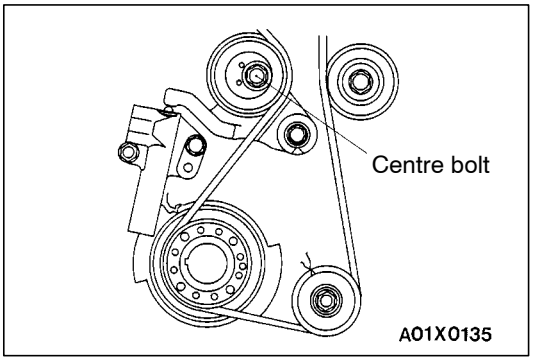


REMOVAL SERVICE POINT

◀A▶ TIMING BELT REMOVAL

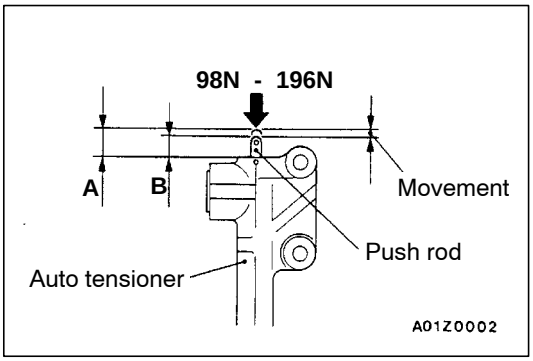
1. Turn the crankshaft clockwise (right turn) to align each timing mark and to set the No. 1 cylinder at compression top dead centre.

   Caution
   The crankshaft should always be turned only clockwise.



2. Loosen the tension pulley centre bolt.
3. Move the tension pulley to the water pump side, and then remove the timing belt.

   Caution
   If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



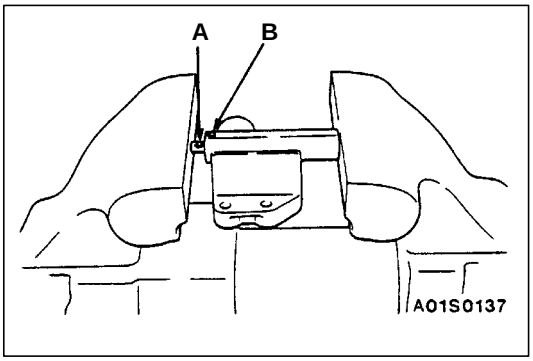
INSTALLATION SERVICE POINTS

▶A◀ AUTO TENSIONER INSTALLATION

1. Apply 98 - 196 N force to the auto tensioner by pressing it against a metal (cylinder block, etc.), and measure the movement of the push rod.

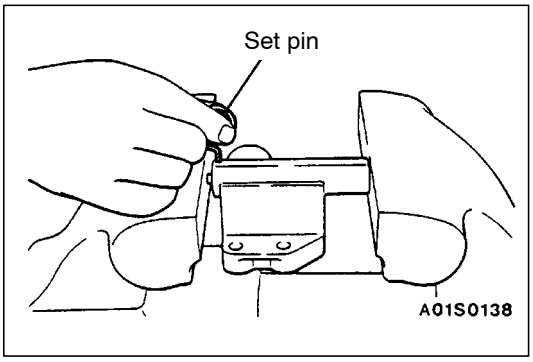
   Standard value: Within 1 mm
   A: Length when it is free (not pressed)
   B: Length when it is pressed
   A - B: Movement

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



3. Use a press or vice to gently compress the auto tensioner push rod until pin hole A of the push rod and pin hole B of the tensioner cylinder are aligned.

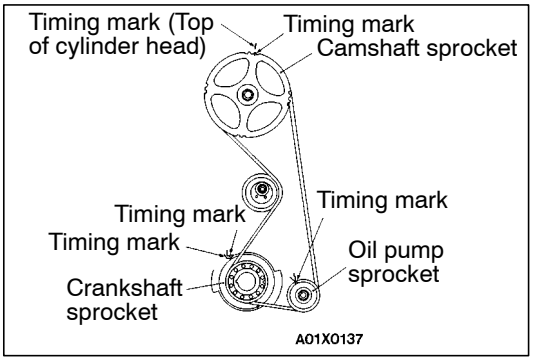
   Caution
   If the compression speed is too fast, the rod may become damaged, so be sure to carry out this operation slowly.



4. Once the holes are aligned, insert the set pin.

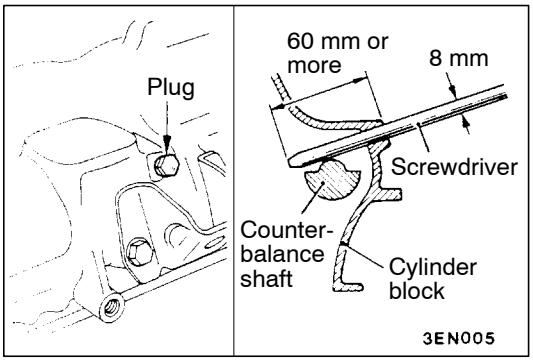
   NOTE
   When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.

5. Install the auto tensioner to the engine.

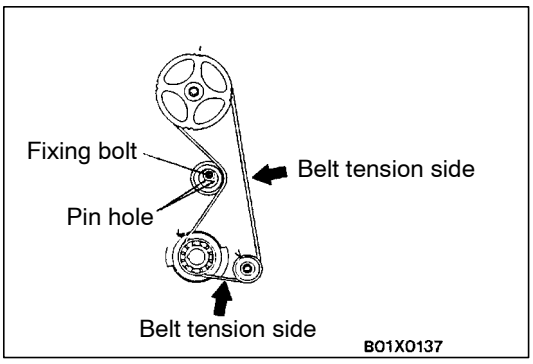


▶B◀ TIMING BELT INSTALLATION

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



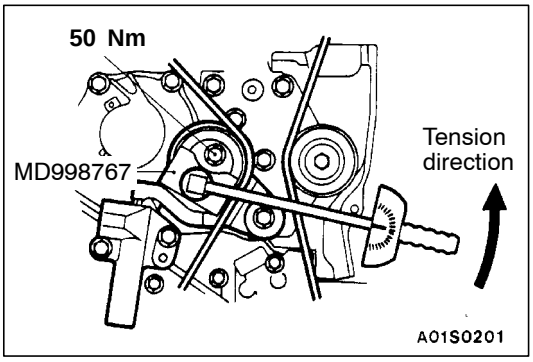
2. After aligning the timing mark on the oil pump sprocket, remove the cylinder block plug and insert a Phillips screwdriver with a diameter of 8 mm, and check to be sure that the screwdriver goes in 60 mm or more. If the screwdriver will only go in 20 - 25 mm before striking the counterbalance shaft, turn the sprocket once, realign the timing mark and check that the screwdriver goes in 60 mm or more. The screwdriver should not be taken out until the timing belt is installed.



3. Install the belt to the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order, so that there is no slackness in the belt tension.

   Caution
   If the timing belt is re-used, install so that the arrow marked on it at time of removal is pointing in the clockwise direction.

4. Set the tension pulley so that the pin holes are at the top, press the tension pulley lightly against the timing belt, and then provisionally tighten the fixing bolt.
5. Adjust the timing belt tension.

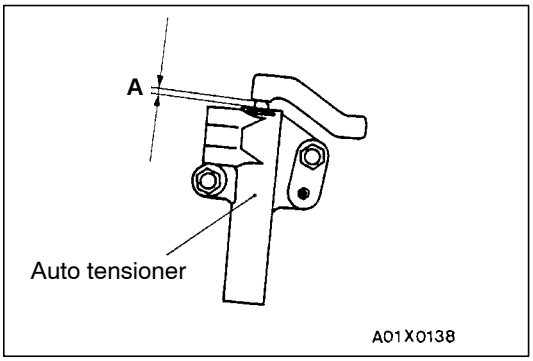


▶C◀ TIMING BELT TENSION ADJUSTMENT

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

   Standard value: 3.5 Nm <Timing belt tension torque>

   Caution
   When tightening the fixing bolt, make sure that the tension pulley does not turn with the bolt.



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

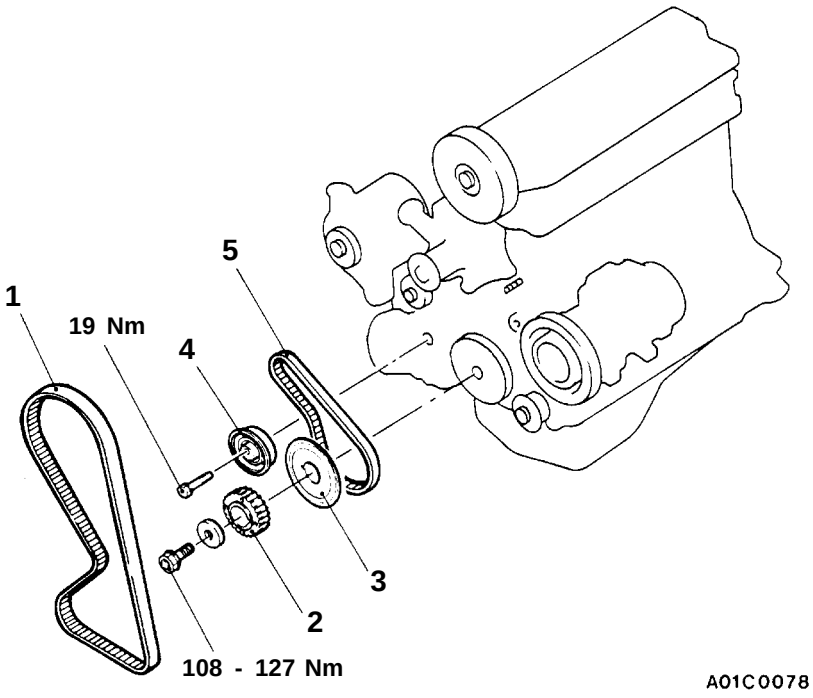
   Standard value (A): 3.8 - 4.5 mm

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

TIMING BELT B

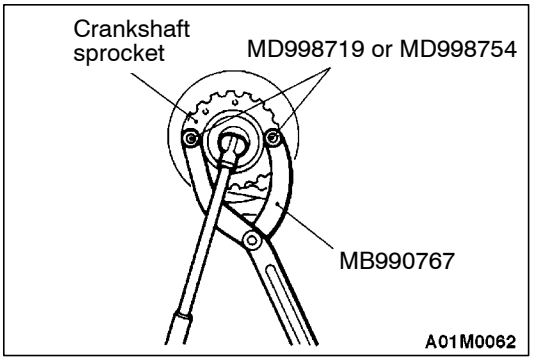
11200460106

REMOVAL AND INSTALLATION



Removal steps

1. Timing belt (Refer to P.11A-26.)
◀A▶ ▶C◀ 2. Crankshaft sprocket
▶B◀ 3. Flange
4. Timing belt B tensioner
◀B▶ ▶A◀ 5. Timing belt B

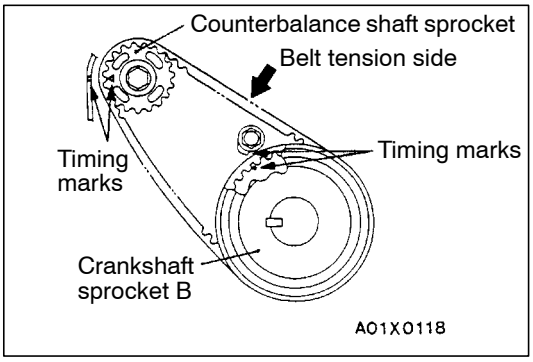


REMOVAL SERVICE POINTS

◀A▶ CRANKSHAFT SPROCKET REMOVAL

◀B▶ TIMING BELT B REMOVAL

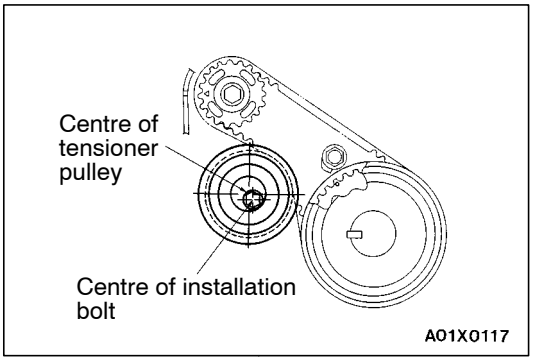
Caution
If timing belt "B" is to be re-used, use chalk to mark it with an arrow on its flat side indicating the turning direction (to the right).



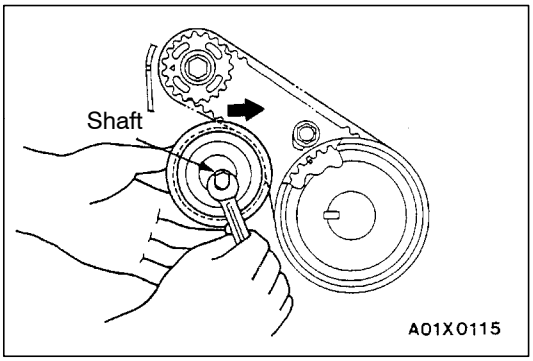
INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT B INSTALLATION, ADJUSTMENT

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

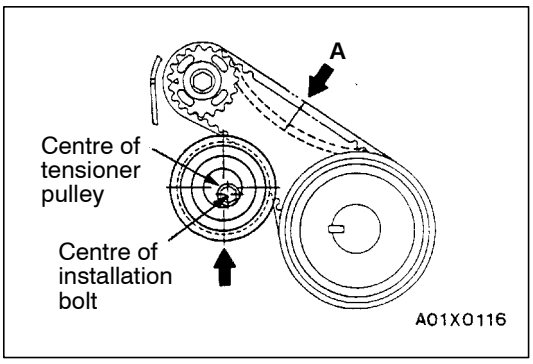


2. Adjust the tension of timing belt “B” by the following procedure.
   (1) Temporarily fix the timing belt “B” tensioner such that the centre of the tensioner pulley is to the left and above the centre of the installation bolt, and temporarily attach the tensioner pulley so that the flange is toward the front of the engine.



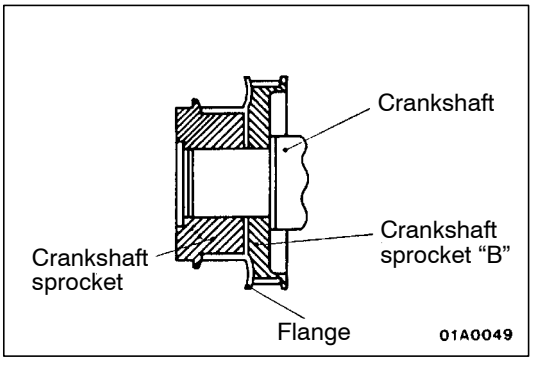
   (2) Holding the timing belt “B” tensioner up with your finger in the direction of the arrow, place pressure on the timing belt so that the tension side of the belt is taut. Now tighten the bolt to fix the tensioner.

   Caution
   When tightening the bolt, ensure that the tensioner pulley shaft does not rotate with the bolt. Allowing it to rotate with the bolt can cause excessive tension on the belt.



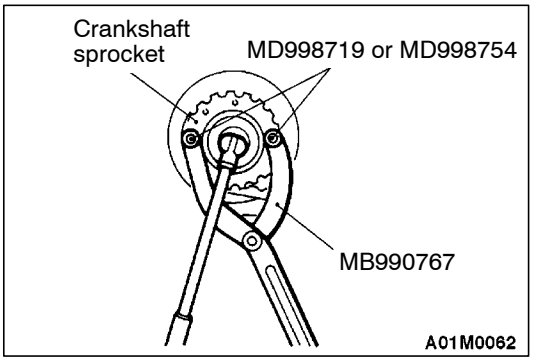
3. To ensure that the tension is correct, depress the belt (point A) with a finger. If not, adjust.

   Standard value: 5 - 7 mm



▶B◀ FLANGE INSTALLATION

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



▶C◀ CRANKSHAFT SPROCKET INSTALLATION

NOTE

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

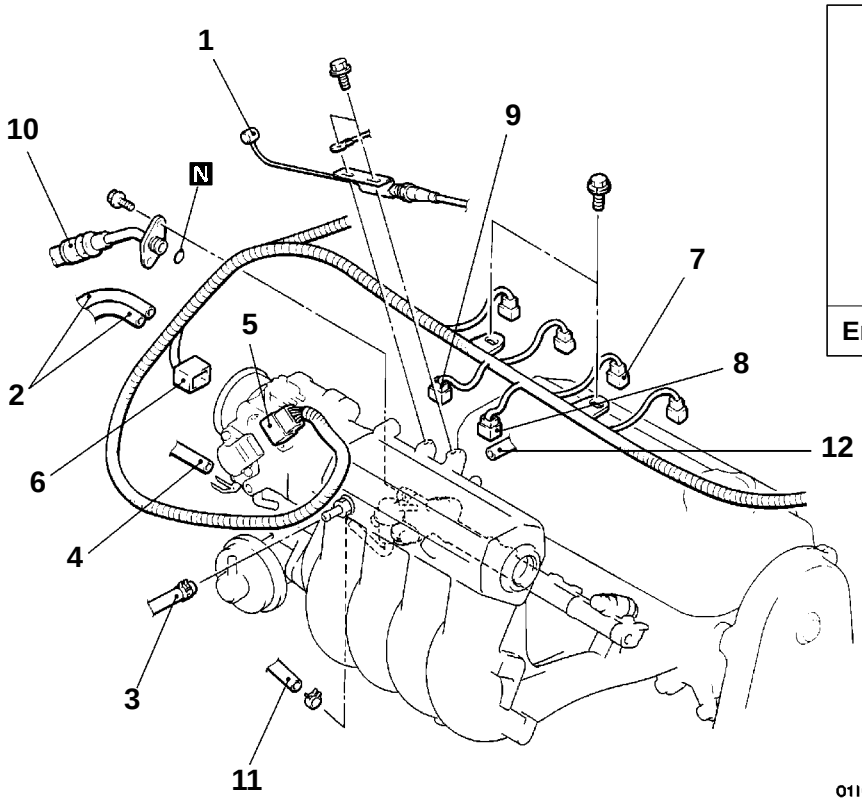
ENGINE ASSEMBLY

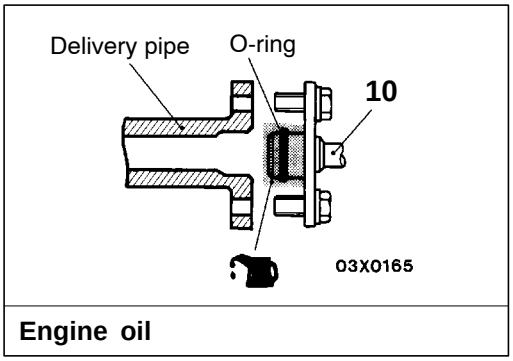
11200090015

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Discharge Prevention (Refer to GROUP 13A - On-vehicle Service.)
- Engine Coolant Draining
- Thermostat Case Assembly Removal (Refer to GROUP 14 - Water Hose and Water Pipe.)
- Front Exhaust Pipe Removal (Refer to GROUP 15.)
- Hood Removal (Refer to GROUP 42.)
- Under Cover Removal
- Radiator Assembly Removal (Refer to GROUP 14.)
- Air Cleaner Removal

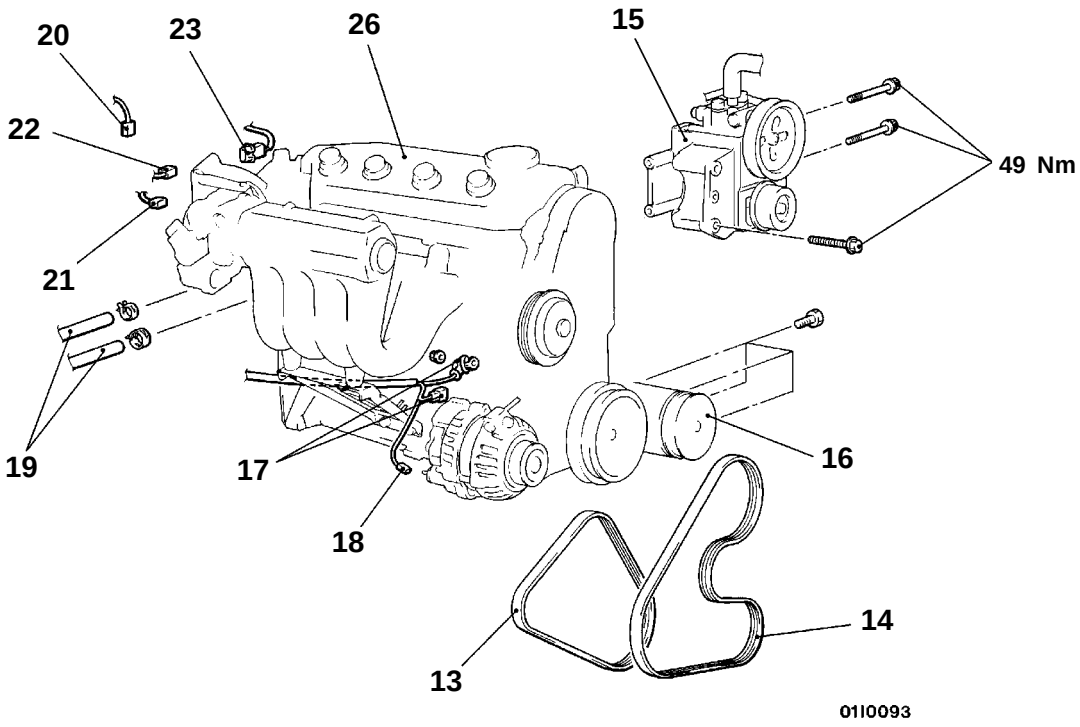
Post-installation Operation
- Thermostat Case Assembly Installation (Refer to GROUP 14 - Water Hose and Water Pipe.)
- Engine Coolant Supplying
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)
- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Hood Installation (Refer to GROUP 42.)
- Under Cover Installation
- Radiator Assembly Installation (Refer to GROUP 14.)
- Air Cleaner Installation

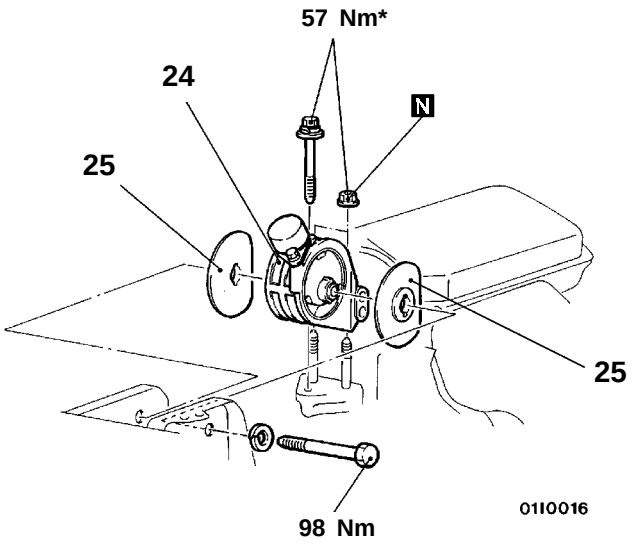




Removal steps

1. Accelerator cable connection
2. Vacuum hose connection
3. Brake booster vacuum hose connection
4. Vacuum hose connection
5. Throttle position sensor connector
6. Idle speed control connector
7. Injector connector
8. Purge control solenoid valve connector
9. EGR solenoid valve connector
- ▶D◀ 10. High-pressure fuel hose connection
11. Fuel return hose connection
12. PCV hose connection





00006485

13. Drive belt (Alternator)
14. Drive belt (Power steering and A/C)
◀A▶ 15. Power steering oil pump and bracket assembly
◀B▶ 16. A/C compressor
17. Alternator connector
18. Oil pressure switch connector
19. Heater hose connection
20. Engine coolant temperature gauge unit connector
21. Engine coolant temperature sensor connector
22. Camshaft position sensor connector
23. Detonation sensor connector
◀C▶ • Transmission assembly
◀D▶ ▶C◀ 24. Engine mount bracket
▶B◀ 25. Engine mount stopper
◀E▶ ▶A◀ 26. Engine assembly

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

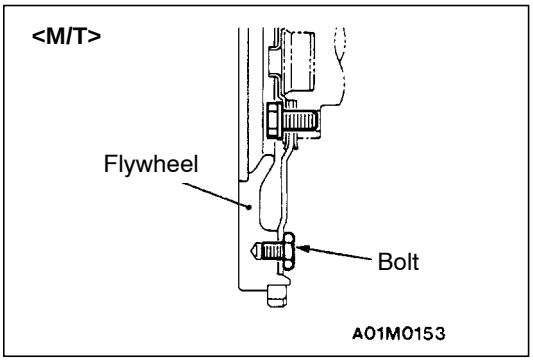
Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

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

◀B▶ A/C COMPRESSOR REMOVAL

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

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

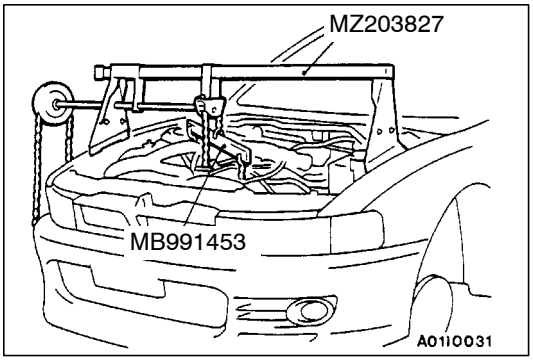


◀C▶ TRANSMISSION ASSEMBLY REMOVAL

<M/T>:
Refer to GROUP 22.

Caution
Do not remove the flywheel mounting bolt shown by the arrow. If this bolt Is removed, the flywheel will become out of balance and damaged.

<A/T>:
Refer to GROUP 23.



◀D▶ 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.

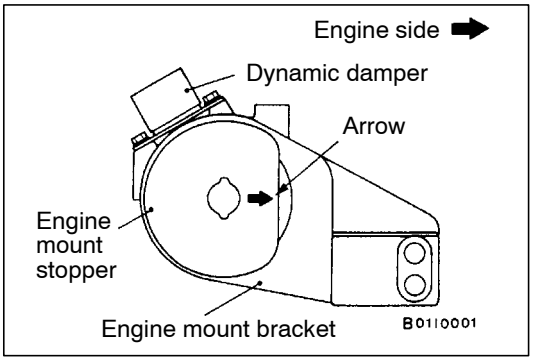
◀E▶ ENGINE ASSEMBLY REMOVAL

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 STOPPER INSTALLATION

Clamp the engine mount stopper so that the arrow points in the direction as shown in the diagram.

▶C◀ ENGINE MOUNT BRACKET INSTALLATION

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

▶D◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

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

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

ENGINE <6A1>

CONTENTS

11109000610

GENERAL INFORMATION

11100010452

Items			6A13
Total displacement mL			2,498
Bore × Stroke mm			81.0 × 80.8
Compression ratio			9.5
Combustion chamber			Pentroof type
Camshaft arrangement			SOHC
Number of valve	Intake		12
	Exhaust		12
Valve timing	Intake	Opening	BTDC 15°
		Closing	ABDC 53°
	Exhaust	Opening	BBDC 53°
		Closing	ATDC 15°
Fuel system			Electronically controlled multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

11100030496

Items			Standard value	Limit
Alternator drive belt tension	Tension N	When checked	294 - 490	-
		When a used belt is installed	343 - 441	-
		When a new belt is installed	490 - 686	-
	Deflection (Reference value) mm	When checked	9.0 - 13.0	-
		When a used belt is installed	10.0 - 12.0	-
		When a new belt is installed	6.8 - 8.0	-
Power steering oil pump and A/C compressor drive belt tension	Tension N	When checked	490 - 686	-
		When a used belt is installed	539 - 637	-
		When a new belt is installed	784 - 980	-
	Deflection (Reference value) mm	When checked	11.0 - 15.0	-
		When a used belt is installed	12.0 - 14.0	-
		When a new belt is installed	8.0 - 12.0	-
Basic ignition timing			5° BTDC±3°	-
Ignition timing			Approx. 7° BTDC	-

Items	Standard value	Limit
Idle speed r/min	650 ± 100	-
CO contents %	0.2 or less	-
HC contents ppm	100 or less	-
Compression pressure (250 - 400 r/min) kPa	1177	Min. 875
Compression pressure difference of all cylinder kPa	-	Max. 98
Intake manifold vacuum kPa	-	Min. 60
Cylinder head bolt shank length mm	-	96.4
Auto-tensioner push rod movement mm	Within 1	-
Timing belt tension torque Nm	3	-
Auto-tensioner rod protrusion amount mm	3.8 - 4.5	-

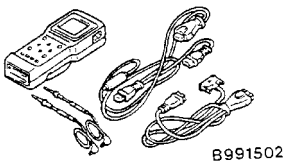
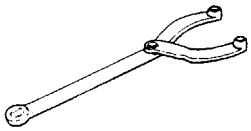
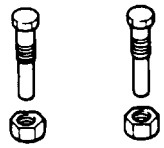
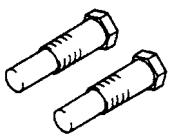
SEALANTS

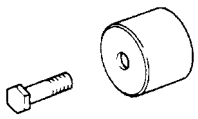
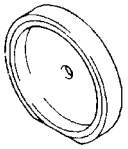
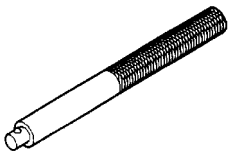
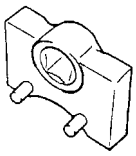
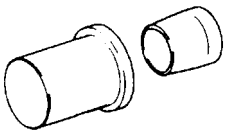
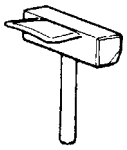
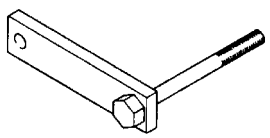
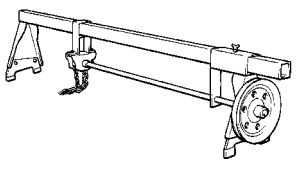
11100050379

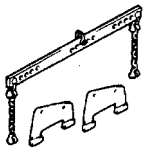
Items	Specified sealants	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Flywheel bolt or drive plate bolt	3M Stud Locking 4170 or equivalent	-

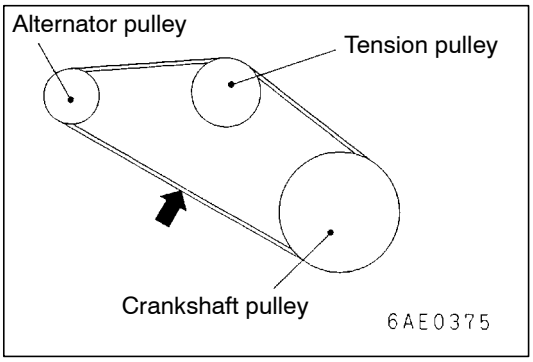
SPECIAL TOOLS

11100060464

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Engine idle speed check Erasing diagnosis code
	MB990767	End yoke holder	• Holding the camshaft sprocket • Holding the crankshaft pulley
	MD998719	Crankshaft pulley holder pin	
	MD998715	Crankshaft pulley holder pin	

Tool	Number	Name	Use
	MD998443	Auto-lash adjuster holder	Supporting of auto-lash adjuster
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	Press-in of the crankshaft rear oil seal
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
	MD998727	Oil pan remover	Removal of oil pan
	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission

Tool	Number	Name	Use
 B991453	MB991453	Engine hanger assembly	Supporting the engine assembly during removal and installation of the transmission



ON-VEHICLE SERVICE

11100090425

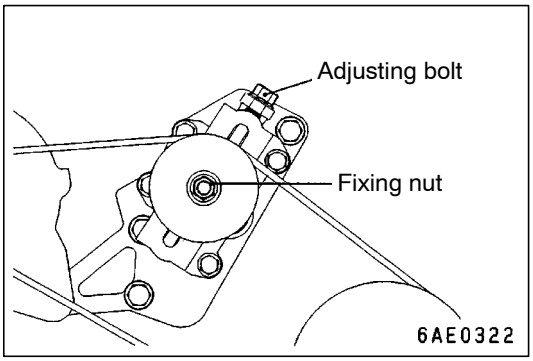
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

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

Standard value:

Tension N	294 - 490
Deflection (Reference value) mm	9.0 - 13.0



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the tension pulley fixing nut.
2. Use the adjusting bolt to adjust the belt tension or deflection to the standard value.

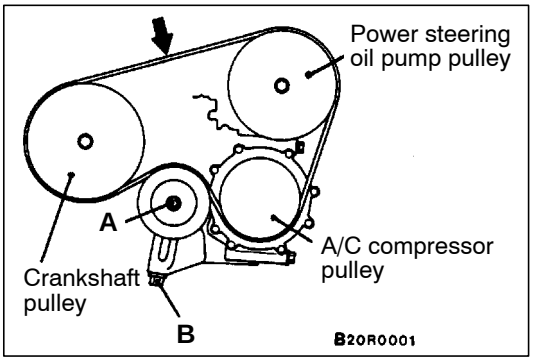
   Standard value:

Items	When a used belt is installed	When a new belt is installed
Tension N	343 - 441	490 - 686
Deflection (Reference value) mm	10.0 - 12.0	6.8 - 8.0

3. Tighten the fixing nut.

   Tightening torque: 49 Nm

   Caution
   Turn the crankshaft one full rotation or more clockwise before this check.



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

11100130134

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

   Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Tension N	490 - 686	539 - 637	784 - 980
Deflection (Reference value) mm	11.0 - 15.0	12.0 - 14.0	8.0-12.0

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

   Tightening torque: 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).

IGNITION TIMING CHECK

11100170280

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

   Standard value: 650 ± 100 r/min

6. Select No.17 of the MUT-II Actuator test.
7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC±3°

8. If the basic ignition timing is outside the standard value, inspect the MPI system while referring to GROUP 13A - Troubleshooting.

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

   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. 7°BTDC

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

IDLE SPEED CHECK 11100350059

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

   Standard value: 5° BTDC±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: 650 ± 100 r/min

   NOTE
   The idle speed is controlled automatically by the idle speed control (ISC) system.
6. If the idle speed is outside the standard value, check the MPI components by referring to GROUP 13A - Troubleshooting.

IDLE MIXTURE CHECK 1110020401

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

   Standard value: 5° BTDC±3°
4. Run the engine at 2,500 r/min for 2 minutes.

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

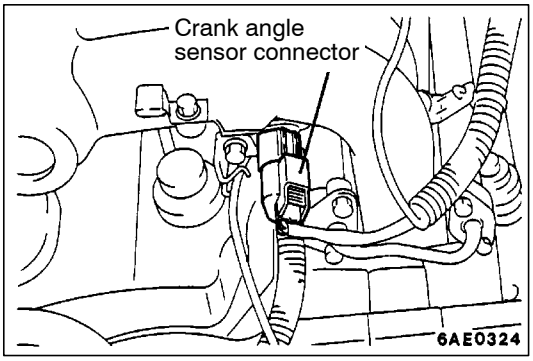
   Standard value
   CO contents: 0.2% or less
   HC contents: 100 ppm or less

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 11100260482

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

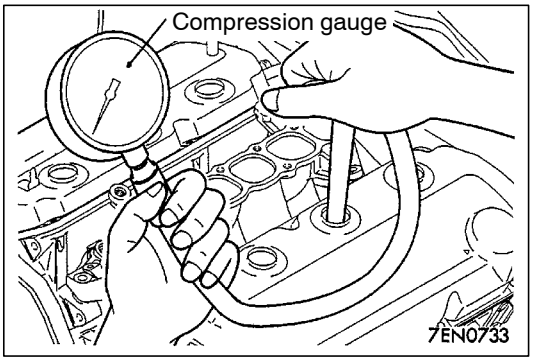


4. Disconnect the crank angle sensor connector.

   NOTE
   Doing this will prevent the engine-ECU from carrying out ignition and fuel injection.

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

   Caution
   1. Keep away from the spark plug hole when cranking.
   2. If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.



6. Set compression gauge to one of the spark plug holes.
7. Crank the engine with the throttle valve fully open and measure the compression pressure.

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

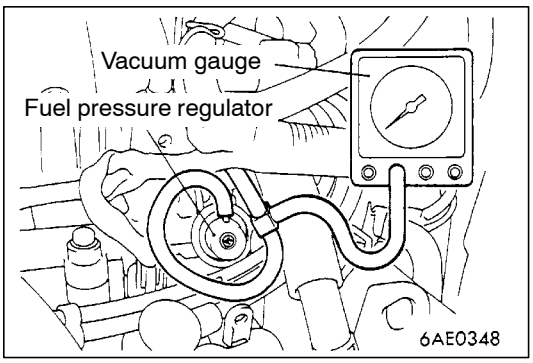
   Limit (at engine speed of 250 - 400 r/min): Min. 875 kPa

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 7 and 8.
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
10. Connect the crank angle sensor connector.
11. Install the spark plugs and spark plug cables.
12. Use the MUT-II to erase the diagnosis codes.

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



MANIFOLD VACUUM CHECK 11100270393

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 the standard value. Then read off the vacuum gauge.

   Limit: Min. 60 kPa

LASH ADJUSTER CHECK

11100290337

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 y the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N → D).
If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings. (In such cases, the lash adjusters are normal.)
4. After the engine has warmed up, run it at idle and check if any noise can be heard.
If the noise has become smaller or has disappeared, the cause of the noise was probably that oil sludge had caused the lash adjusters to become stuck. If this happens, carry out the following check. If the noise level does not change, go to step 5.
(1) Let the engine cool down sufficiently.
(2) Turn the crankshaft two full revolutions.

(3) Carry out lash adjuster simple check. (Refer to P.11B-12.)
- If any of the rocker arms can be pushed down easily during the lash adjuster simple check, replace the corresponding lash adjusters.
- If the lash adjuster simple check has been carried out but all lash adjusters are normal (if none of the rocker arms could be pushed down easily), check for some other cause of the problem.

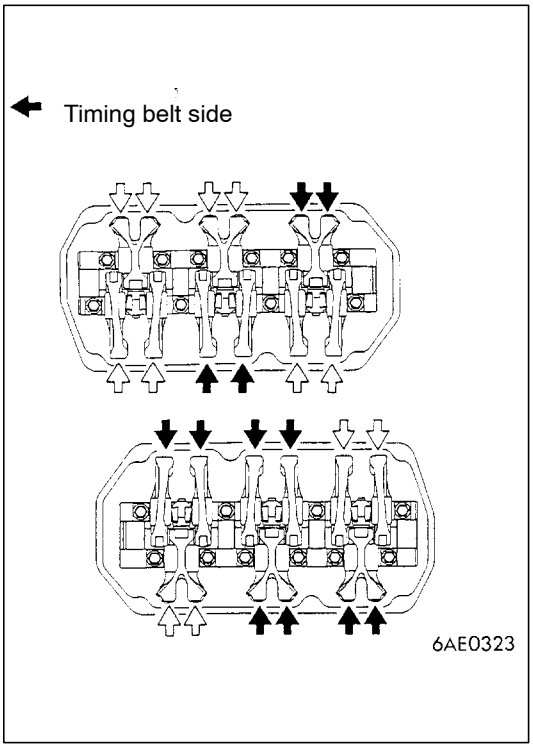
NOTE
You can check whether the lash adjusters are normal or not by carrying out a leak-down test. (Refer to the Engine Workshop Manual.)

Caution
Make sure that the air has been fully bled before installation of a new lash adjuster. (Refer to the Engine Workshop Manual.)

5. Bleed the air from the lash adjusters. (Refer to P.11B-12.)
6. If the noise does not disappear even after the air has been bled from the lash adjusters, carry out the following check.
   Carry out lash adjuster simple check. (Refer to P.11B-12.)
   - If one of the rocker arms can be pushed down easily during the lash adjuster simple check, replace the corresponding lash adjuster.
   - If two or more of the rocker arms can be pushed down easily during the lash adjuster simple check, the cause may be that the oil passage to the cylinder head is blocked.
     Check for blockages in the oil passage, and clear the blockages if any are found. If there are no blockages, replace the lash adjusters.
   - If the lash adjuster simple check has been carried out but all lash adjusters are normal (if none of the rocker arms could be pushed down easily), check for some other cause of the problem.

   NOTE
   You can check whether the lash adjusters are normal or not by carrying out a leak-down test. (Refer to the Engine Workshop Manual.)

   Caution
   Make sure that the air has been fully bled before installation of a new lash adjuster. (Refer to the Engine Workshop Manual.)
7. Start the engine and check that the abnormal noise has disappeared. If necessary, bleed the air from the lash adjusters. (Refer to P.11B-12.)



<LASH ADJUSTER SIMPLE CHECK>

1. Stop the engine.
2. Remove the rocker cover.
3. Set the No.1 cylinder to the compression top dead centre position.
4. Check the rocker arms indicated by white arrows in the illustration by the procedures given below.

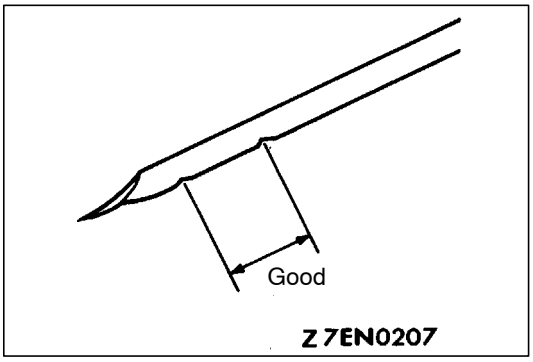
   <Checking an intake-side rocker arm>
   Check whether the rocker arm moves downwards when the part of the rocker arm which touches the top of the lash adjuster is pushed.
   - If the rocker arm moves down easily when it is pushed, make a note of which is the corresponding lash adjuster.
   - If the rocker arm feels extremely stiff when it is pushed and does not move down, the lash adjuster is normal, so check for some other cause of the problem.

   <Checking an exhaust-side rocker arm>

   NOTE
   It will not be possible to depress the Y-shaped rocker arm at the exhaust valve side if one lash adjuster is defective but the other one is normal. In such cases, carry out the following procedure using a thickness gauge.
   (1) Check that a thickness gauge with a thickness of 0.1 - 0.2 mm can be inserted easily between the valve and the lash adjuster.
   (2) If the thickness gauge can be inserted easily, make a note of which is the corresponding lash adjuster.
   (3) If the thickness gauge cannot be inserted easily, the lash adjuster is normal, so check for some other cause of the problem.
5. Slowly turn the crankshaft 360° in the clockwise direction.
6. Check the rocker arms indicated by black arrows in the illustration in the same way as explained in step 4.

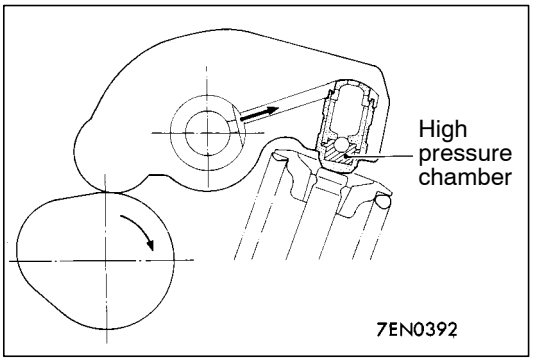
<LASH ADJUSTER AIR BLEEDING>

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.

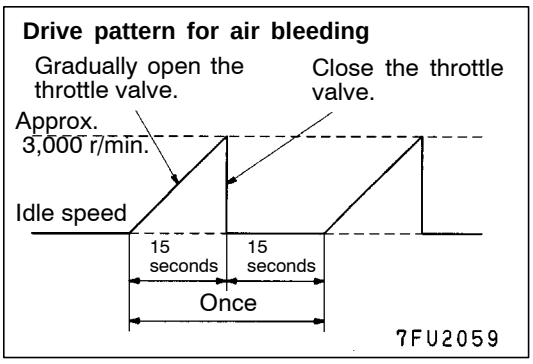


1. Check the engine oil and replenish or replace the oil if necessary.

   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.

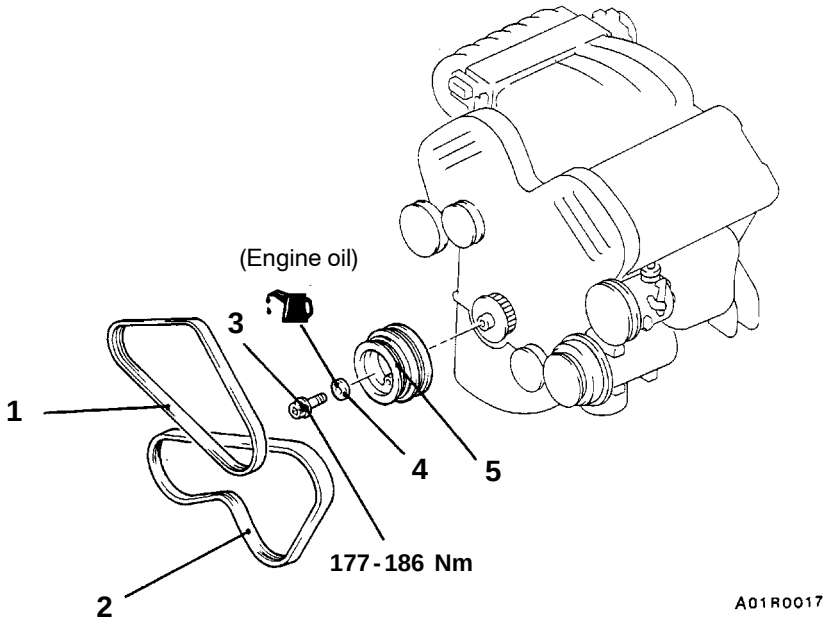
CRANKSHAFT PULLEY

11200160310

REMOVAL AND INSTALLATION

Pre-removal Operation
- Under Cover Removal

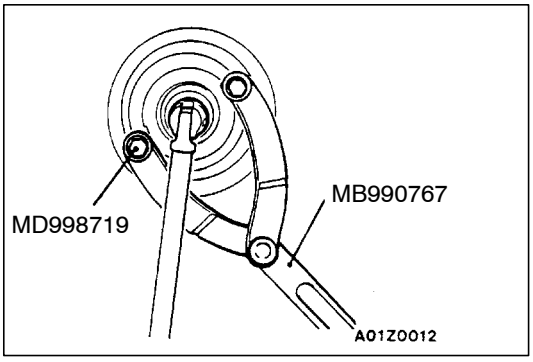
Post-installation Operation
- Drive Belt Tension Adjustment (Refer to P.11B-5.)
- Under Cover Installation



Removal steps

1. Drive belt (Power steering oil pump, or A/C compressor and power steering oil pump)
2. Drive belt (Alternator)

◀A▶ ▶A◀ 3. Crankshaft bolt
4. Washer
5. Crankshaft pulley



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT BOLT REMOVAL

INSTALLATION SERVICE POINT

▶A◀ CRANKSHAFT BOLT INSTALLATION

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

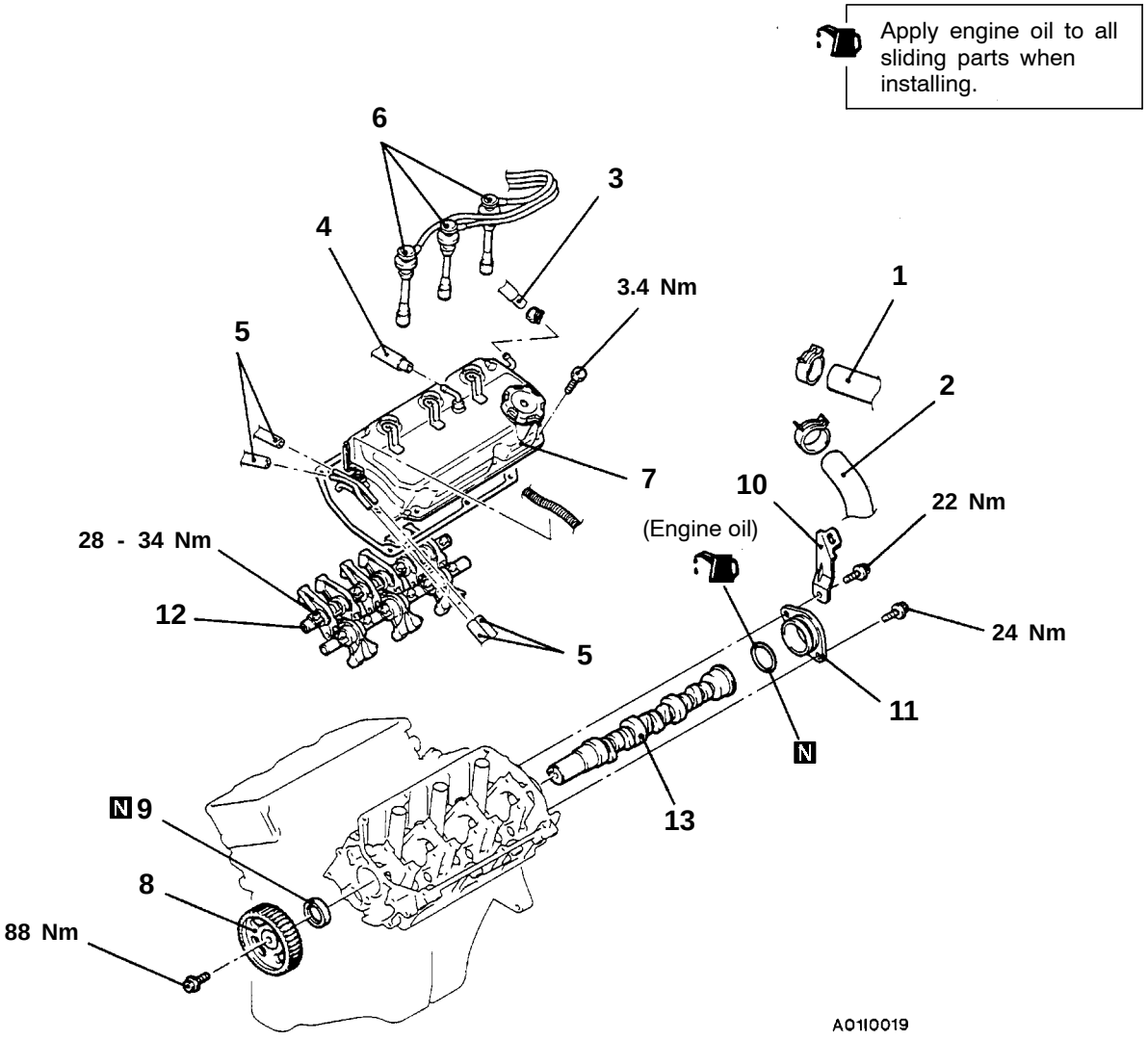
CAMSHAFT AND CAMSHAFT OIL SEAL

11200220124

REMOVAL AND INSTALLATION

<Front bank>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Air Intake Hose Assembly Removal and Installation
- Timing Belt Removal and Installation (Refer to P.11B-26.)
- Drive Belt Tension Adjustment (Refer to P.11B-5.)



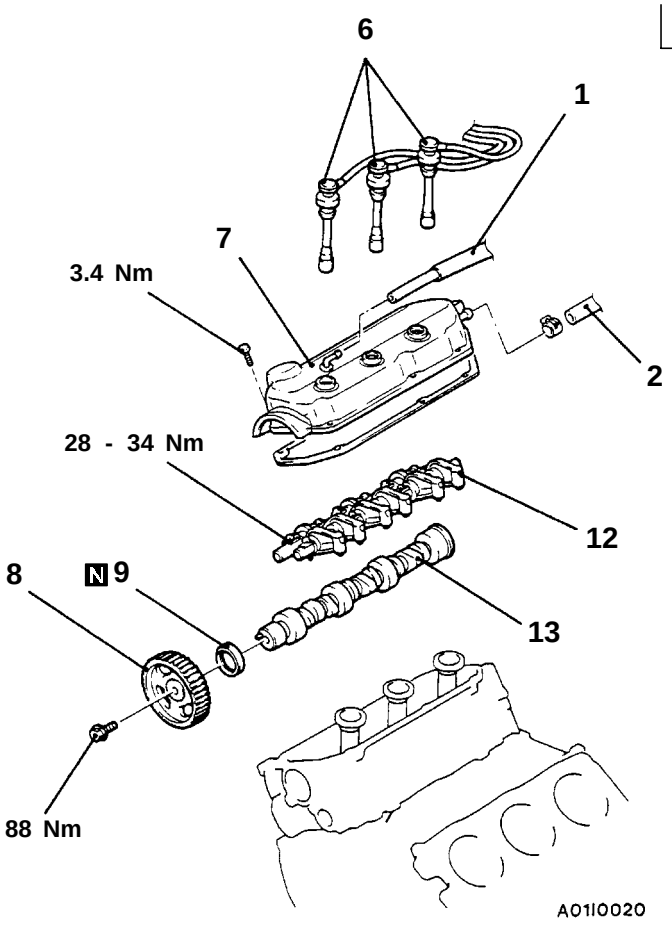
Removal steps

◀A▶ ▶D◀ 1. Radiator upper hose connection
◀A▶ ▶D◀ 2. Radiator lower hose connection
3. Blow-by hose connection
4. PCV hose connection
5. Vacuum hose connection
6. Spark plug cable
7. Rocker cover
◀B▶ ▶C◀ 8. Camshaft sprocket
▶B◀ 9. Camshaft oil seal
10. Engine hanger
11. Thrust case
◀C▶ 12. Rocker arm and shaft assembly
▶A◀ 13. Camshaft

<Rear bank>

Pre-removal and Post-installation Operation
- Air Intake Plenum Removal and Installation (Refer to GROUP 15.)
- Timing Belt Removal and Installation (Refer to P.11B-26.)
- Distributor Removal and Installation (Refer to GROUP 16.)
- Drive Belt Tension Adjustment (Refer to P.11B-5.)

Apply engine oil to all sliding parts when installing.



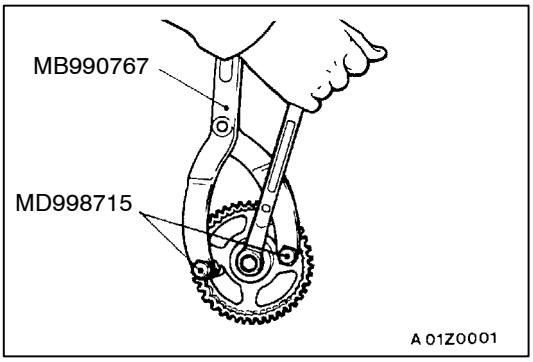
Removal steps

1. Breather hose connection
2. Blow-by hose connection
6. Spark plug cable
7. Rocker cover
◀B▶ ▶C◀ 8. Camshaft sprocket
▶B◀ 9. Camshaft oil seal
◀C▶ 12. Rocker arm and shaft assembly
▶A◀ 13. Camshaft

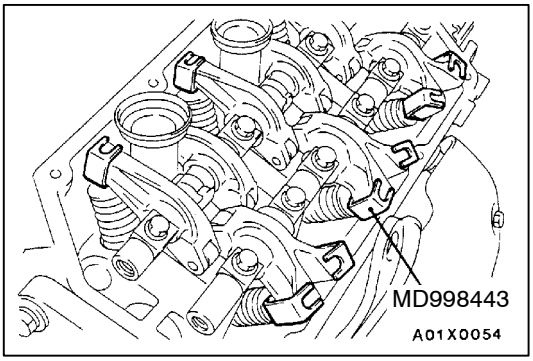
REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

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



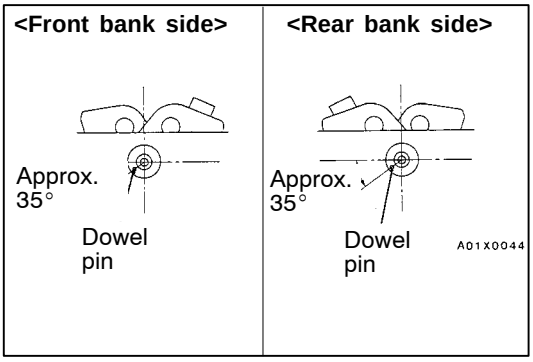
◀B▶ CAMSHAFT SPROCKET REMOVAL



◀C▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

1. Install the special tools as shown in the illustration so that the lash adjusters will not fall out.
2. Loosen the rocker arm and shaft assembly mounting bolt, and then remove the rocker arm and shaft assembly with the bolt still attached.

Caution
Never disassemble the rocker arm and shaft assembly.

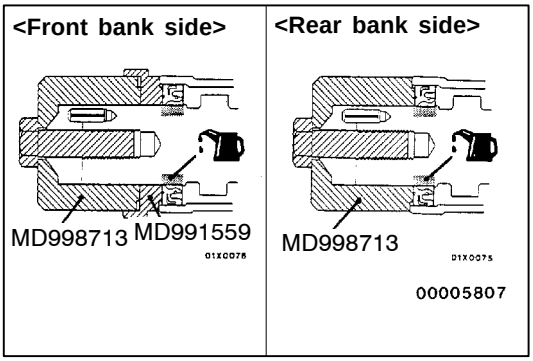


INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

Set the camshaft dowel pins so that they are in the position shown in the illustration.

Caution
Do not mistake the camshafts for the front bank and the rear bank. The camshaft for the rear bank has a slit with a width of approximately 4 mm on its rear end.



▶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.

▶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

▶D◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

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

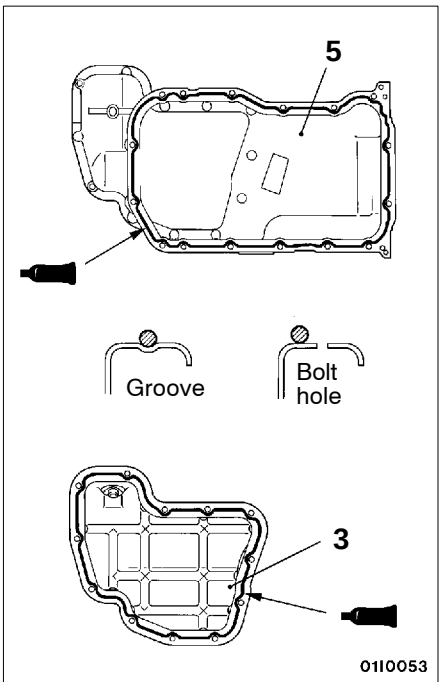
Caution
Be sure to install the clamp as far as the old clamp position.

OIL PAN

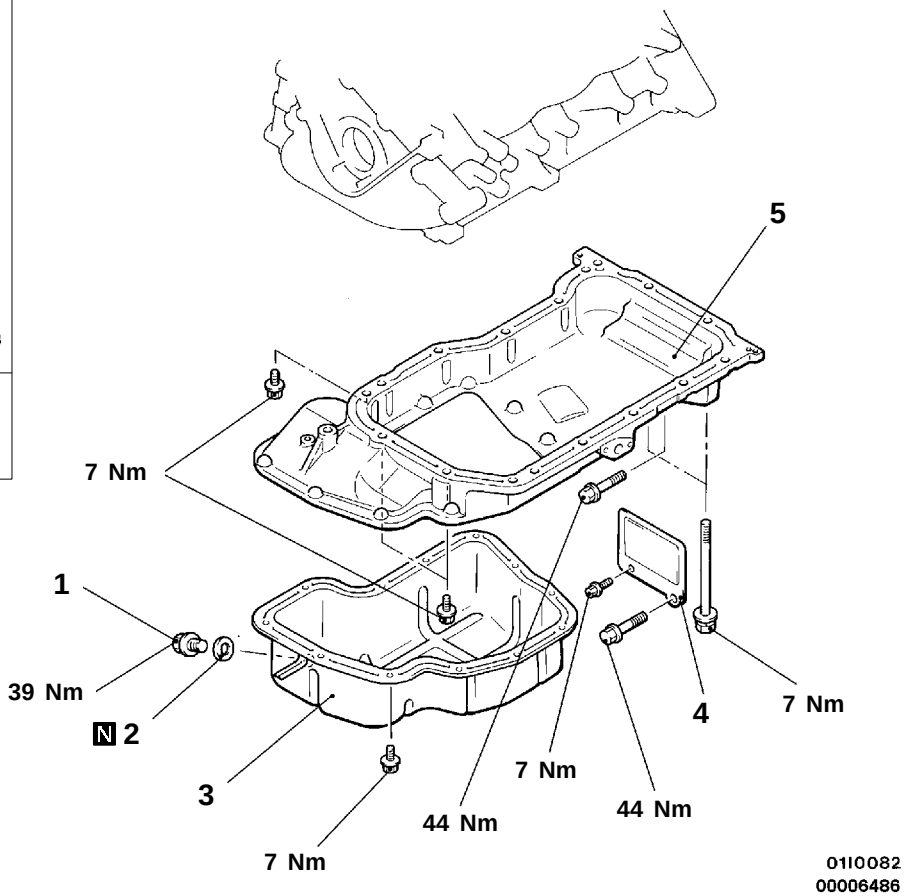
11200280214

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Oil Draining and Supplying (Refer to GROUP 12 - On-vehicle Service.)
- Oil Level Gauge Removal and Installation
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Under Cover Removal and Installation
- Starter Motor Removal and Installation



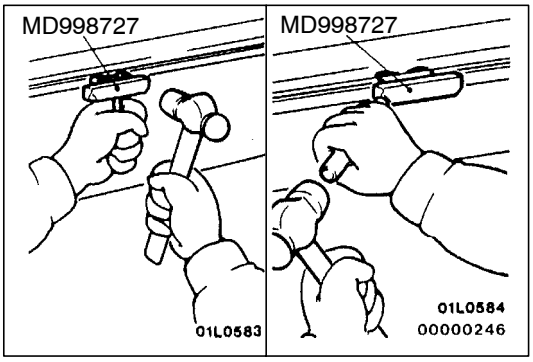
Sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent



Removal steps

1. Drain plug
2. Drain plug gasket
3. Lower oil pan
4. Cover
5. Upper oil pan

▶A◀ ◀A▶ ◀A▶

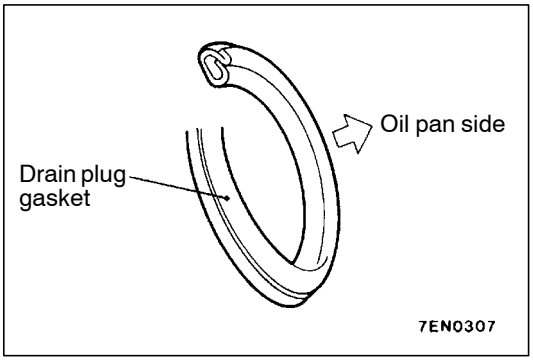


REMOVAL SERVICE POINT

◀A▶ LOWER OIL PAN/UPPER OIL PAN REMOVAL

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

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



INSTALLATION SERVICE POINT

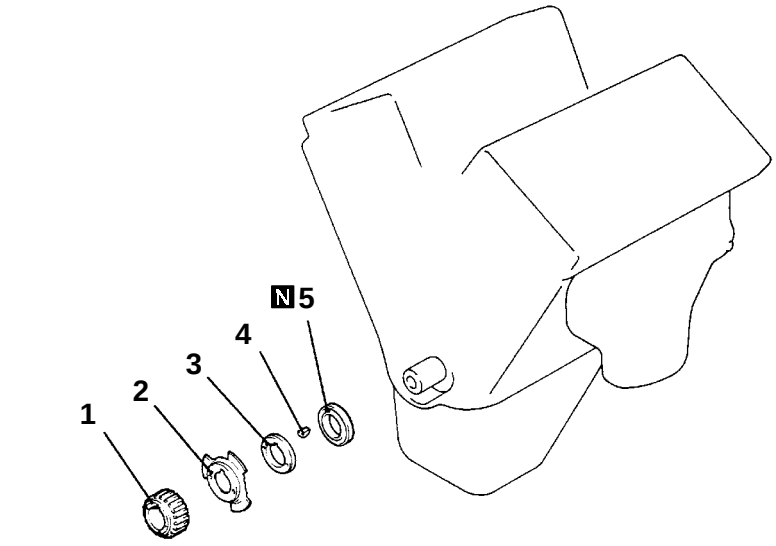
▶A◀ DRAIN PLUG GASKET INSTALLATION

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

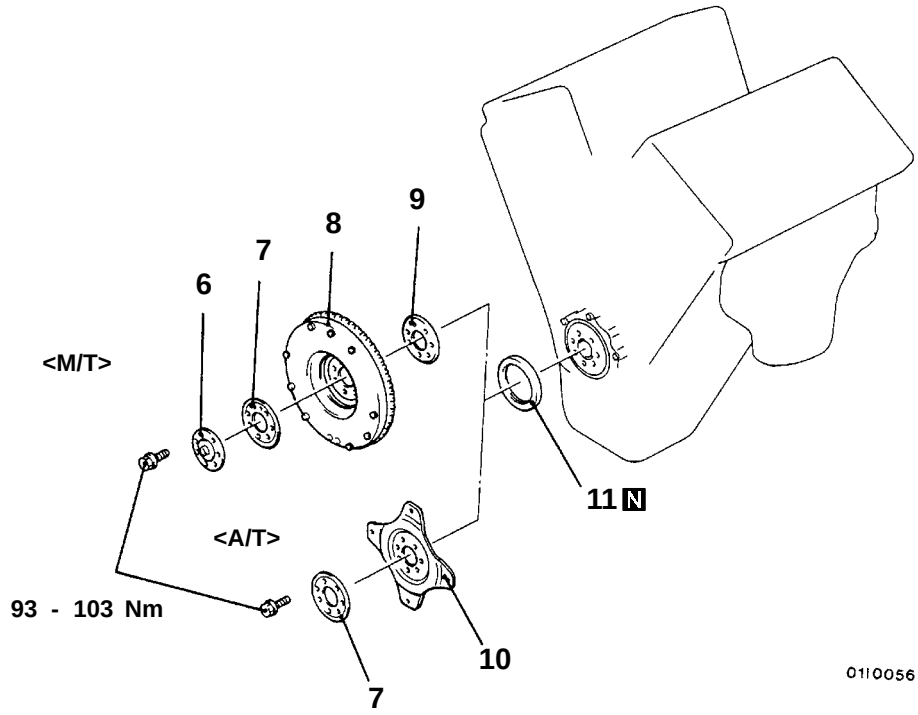
CRANKSHAFT OIL SEAL

11200310142

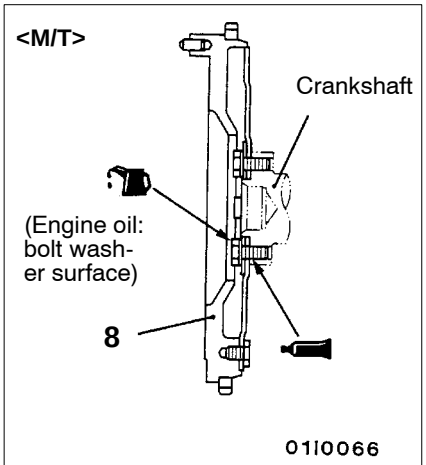
REMOVAL AND INSTALLATION



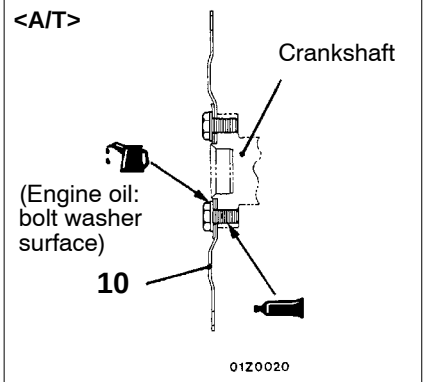
01M0073



01I0056

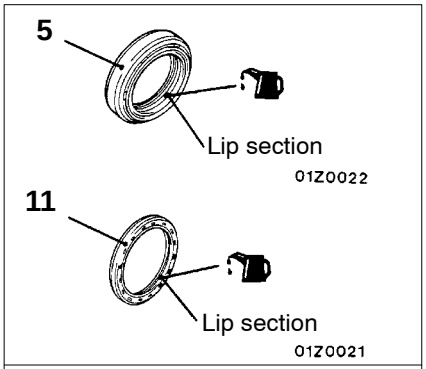


01I0066



01Z0020

Sealant: 3M Stud Locking 4170 or equivalent



Engine oil

00005812

Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11B-26.)
- Crank angle sensor (Refer to GROUP 16.)

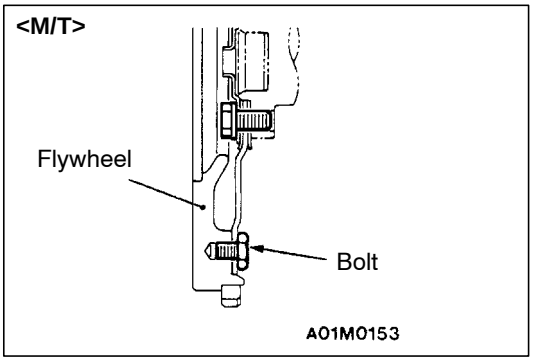
1. Crankshaft sprocket
2. Crankshaft sensing blade
3. Crankshaft spacer
4. Key

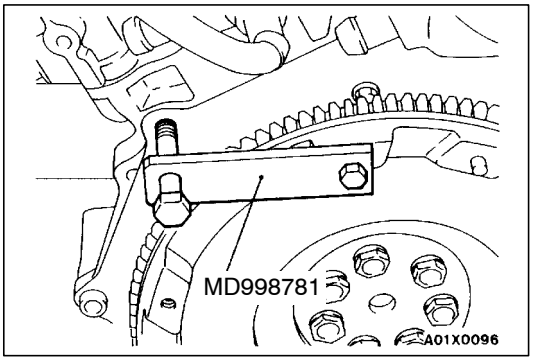
▶C◀ 5. Crankshaft front oil seal

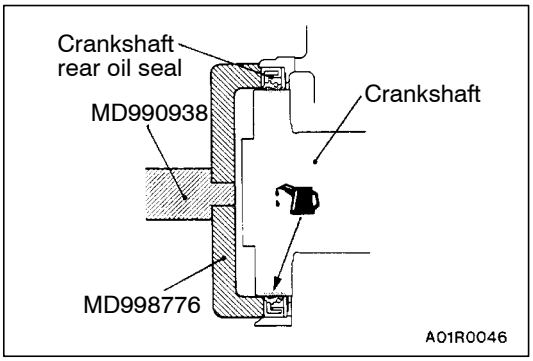
◀A▶
- Transmission assembly
- Clutch cover and disc <M/T>

◀B▶ ▶B◀ 6. Plate <M/T>
◀B▶ ▶B◀ 7. Adapter plate
◀B▶ ▶B◀ 8. Flywheel <M/T>
◀B▶ ▶B◀ 9. Adapter plate <M/T>
◀B▶ ▶B◀ 10. Drive plate <A/T>
▶A◀ 11. Crankshaft rear oil seal

Crankshaft rear oil seal removal steps







REMOVAL SERVICE POINTS

◀A▶ TRANSMISSION ASSEMBLY REMOVAL

<M/T>:
Refer to GROUP 22.

Caution
Do not remove the flywheel mounting bolt shown by the arrow. If this bolt Is removed, the flywheel will become out of balance and damaged.

<A/T>:
Refer to GROUP 23.

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

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

INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

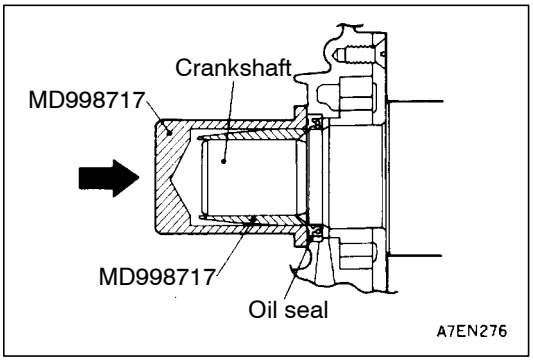
1. Apply a small mount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

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

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

   Specified sealant: 3M Stud locking 4170 or equivalent

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



▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

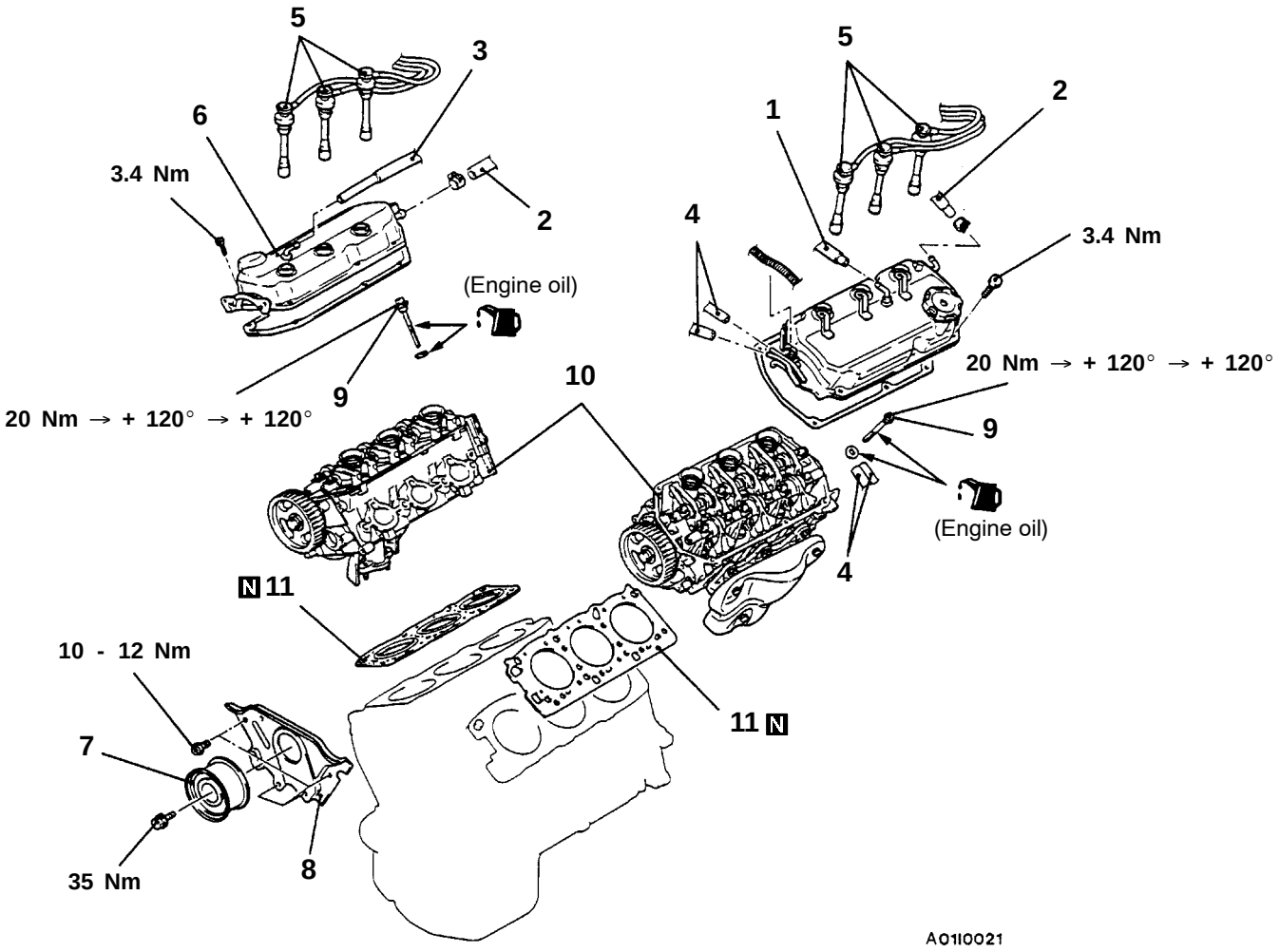
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap the oil seal unit it is flush with the oil seal case.

CYLINDER HEAD GASKET

11200400559

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Air Intake Hose Assembly Removal and Installation
- Radiator Assembly Removal and Installation (Refer to GROUP 14 - Radiator.)
- Air Intake Plenum and Intake Manifold Removal and Installation (Refer to GROUP 15 - Air Intake Plenum.)
- Engine Cover Removal and Installation
- Drive Belt Tension Adjustment (Refer to P.11B-5.)
- Timing Belt Removal and Installation (Refer to P.11B-26.)
- Fuel Discharge Prevention (Refer to GROUP 13A - On-vehicle Service.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Thermostat Case Assembly Removal and Installation (Refer to GROUP 14 - Water Hoses and Pipes.)
- Water Inlet Pipe Removal and Installation (Refer to GROUP 14 - Water Hoses and Pipes.)



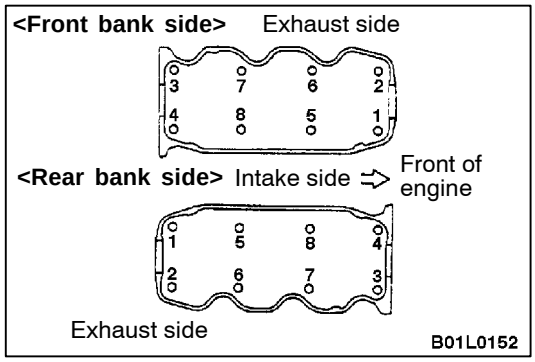
Removal steps

1. PCV hose connection
2. Blow-by hose connection
3. Breather hose connection
4. Vacuum hose connection
5. Spark plug cable
6. Rocker cover
7. Idler pulley
8. Timing belt rear centre cover

◀A▶ ▶B◀ 9. Cylinder head bolt

10. Cylinder head assembly

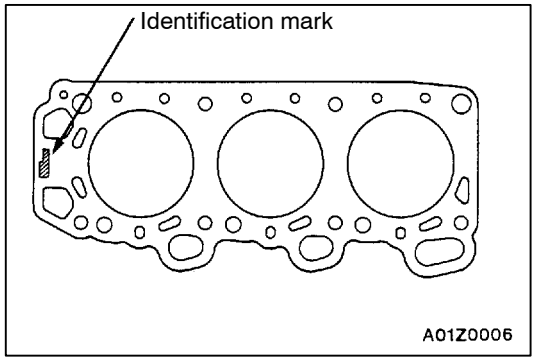
▶A◀ 11. Cylinder head gasket



REMOVAL SERVICE POINT

◀A▶ CYLINDER HEAD BOLT REMOVAL

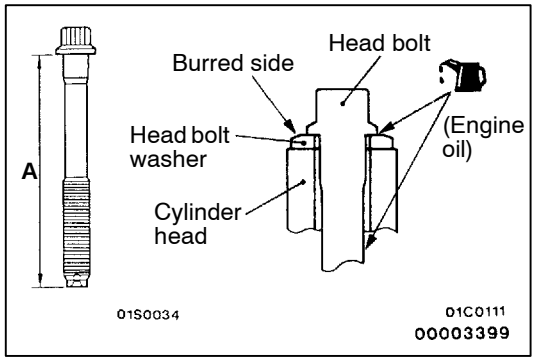
Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head assembly.



INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

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

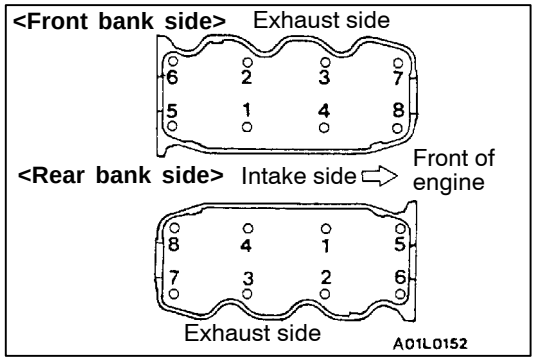


▶B◀ CYLINDER HEAD BOLT INSTALLATION

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

   Limit (A): 96.4 mm

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



4. Install the bolts by the following procedure.
   (1) Tighten the bolts to 20 Nm in the sequence shown in the illustration.
   (2) From the position in (1) above, turn each bolt a further 120° in the same sequence.
   (3) Turn each bolt a further 120° in the same sequence.

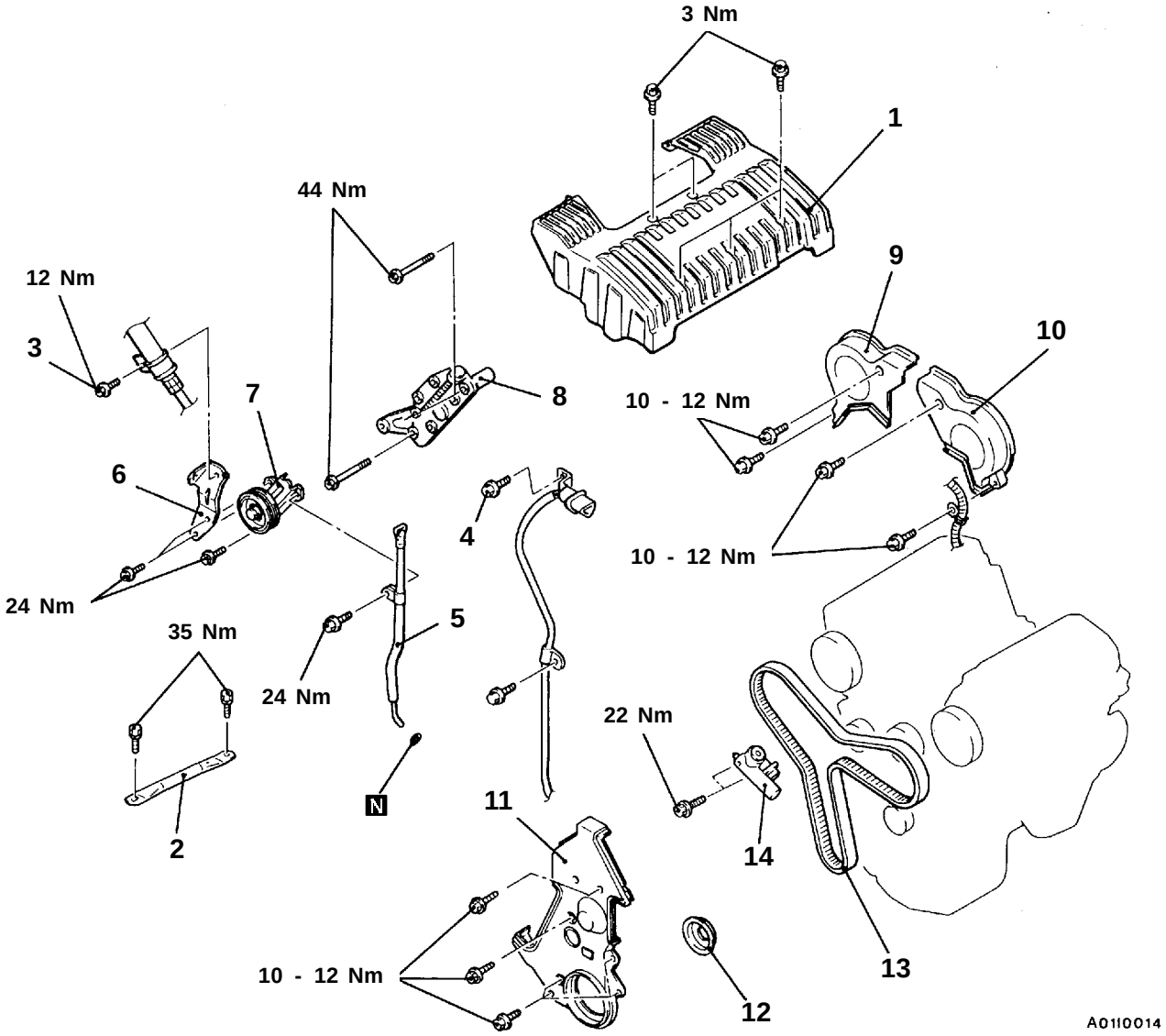
   Caution
   1) If the tightening angle is less than 120°, that bolt will not be sufficiently tight.
   2) If a bolt is tightened by more than the specified angle, loosen the bolts and repeat the procedure from step (1).

TIMING BELT

11200430480

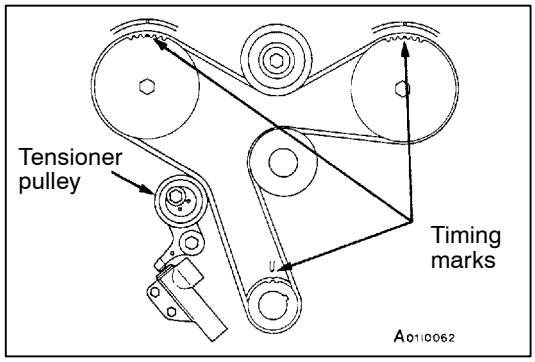
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Crankshaft Pulley Removal and Installation
- Alternator Removal and Installation (Refer to GROUP 16.)
- Drive Belt Tension Adjustment (Refer to P.11B-5.)



Removal steps

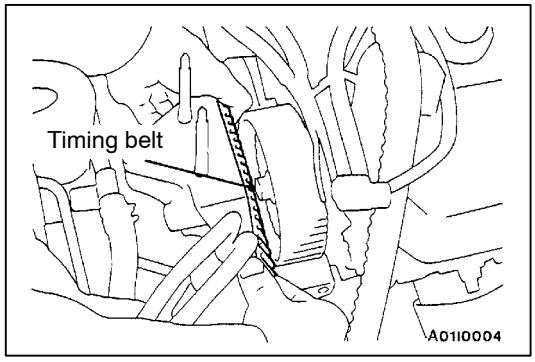
1. Engine cover
2. Engine mount stay
3. Power steering hose clamp bolt
4. Crank angle sensor mounting bolt
5. Oil level gauge assembly
6. Engine hanger
7. Tension pulley bracket assembly
8. Tensioner bracket
9. Timing belt cover (front, upper right)
10. Timing belt cover (front, upper left)
11. Timing belt cover (front, lower)
12. Flange
- ▶C◀ ● Timing belt tension adjustment
- ◀A▶ ▶B◀ 13. Timing belt
- ▶A◀ 14. Auto tensioner



REMOVAL SERVICE POINT

◀A▶ TIMING BELT REMOVAL

1. Align each of the timing marks.

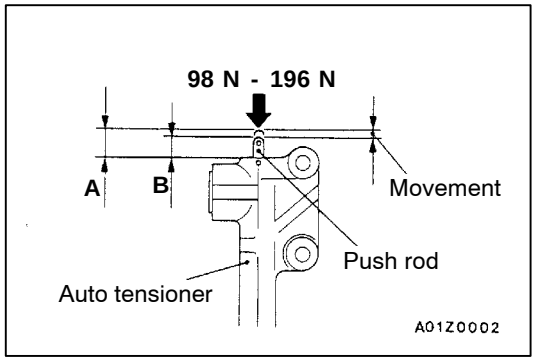


2. Loosen the centre bolt of the tension pulley and remove the timing belt.

Caution
(1) If the timing belt is to be reused, use chalk to mark it with an arrow on its flat side indicating the turning direction.
(2) If the timing belt is to be re-used, be careful not to damage the teeth of the timing belt against the edges of the camshaft sprocket when removing the timing belt.

INSTALLATION SERVICE POINTS

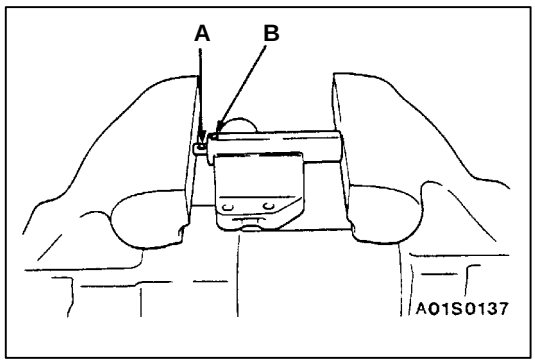
▶A◀ AUTO TENSIONER INSTALLATION



1. Apply 98 - 196 N force to the auto tensioner by pressing it against a metal (cylinder block, etc.), and measure the movement of the push rod.

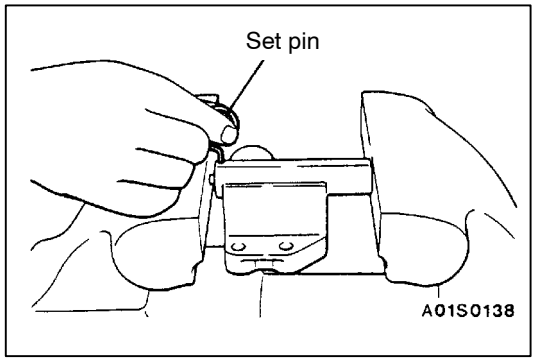
Standard value: Within 1 mm
A: Length when it is free (not pressed)
B: Length when it is pressed
A - B: Movement

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



3. Use a press or vice to gently compress the auto tensioner push rod until pin hole A of the push rod and pin hole B of the tensioner cylinder are aligned.

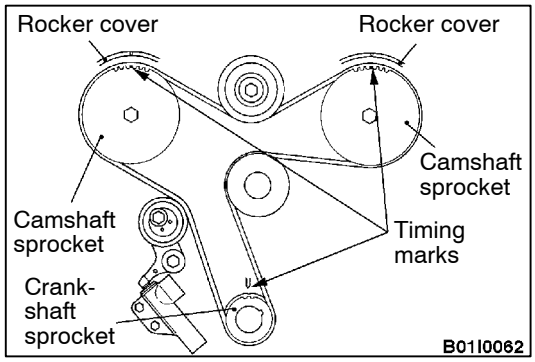
Caution
If the compression speed is too fast, the rod may become damaged, so be sure to carry out this operation slowly.



4. Once the holes are aligned, insert the set pin.

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

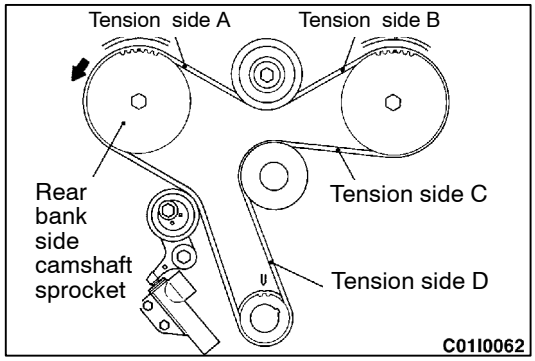
5. Install the auto tensioner to the engine.



▶B◀ TIMING BELT INSTALLATION

1. Check that the timing marks of the both camshaft sprockets and the crankshaft sprocket are aligned.

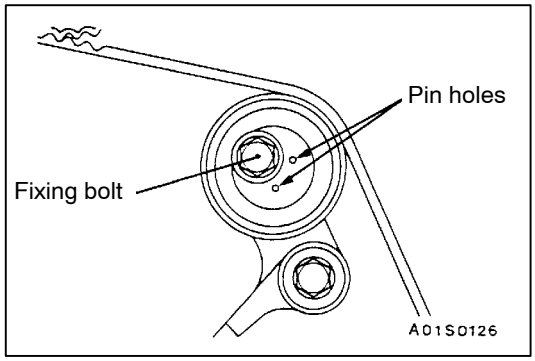
   NOTE
   In this condition, the No.1 cylinder will be in the compression top dead centre position.



2. Install the timing belt so that there is no slackness on the tension sides of the belt (A, B, C and D).

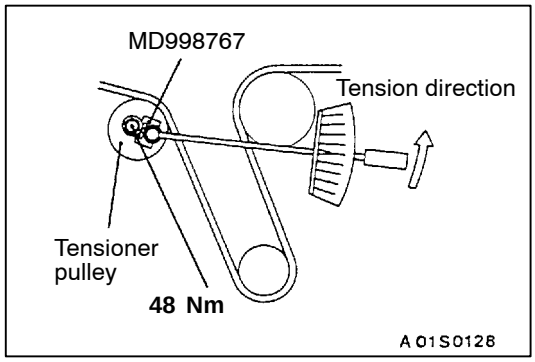
   Caution
   Be careful not to damage the teeth of the timing belt against the edges of the camshaft sprocket when installing the timing belt.

   NOTE
   If reusing the old timing belt, install it so that the arrow made on the belt during removal is pointing in the direction of rotation (clockwise).



3. Set the tensioner pulley so that the pin holes are at the bottom, press the tensioner pulley lightly against the timing belt, and then provisionally tighten the fixing bolt.

4. Apply force to the rear bank side camshaft sprocket in the direction of the arrow to apply tension to the tension sides (A, B, C and D), and check that all of the timing marks are aligned at this time.

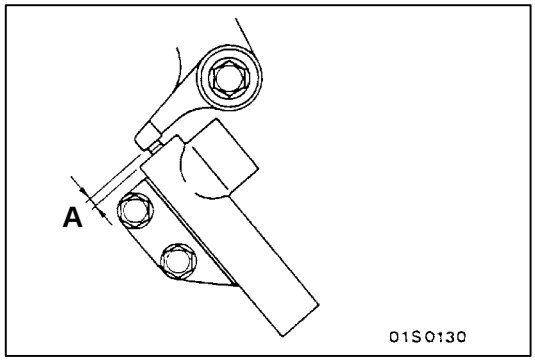


▶C◀ TIMING BELT TENSION ADJUSTMENT

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

   Standard value: 3 Nm <Timing belt tension torque>

   Caution
   When tightening the fixing bolt, make sure that the tensioner pulley does not turn with the bolt.



3. Turn the crankshaft two revolutions in the clockwise direction, and after leaving it for 5 minutes or more, check if the set pin of the auto tensioner can be removed and inserted easily.

   NOTE
   If the set pin cannot be inserted easily, the auto tensioner is good. Check if the amount of protrusion of the auto tensioner rod is within the standard value.

   Standard value (A): 3.8 - 4.5 mm

   If the amount of protrusion is outside the standard value, repeat the procedure in steps 1 to 3
4. Check to be sure that the timing marks of each sprocket are aligned.

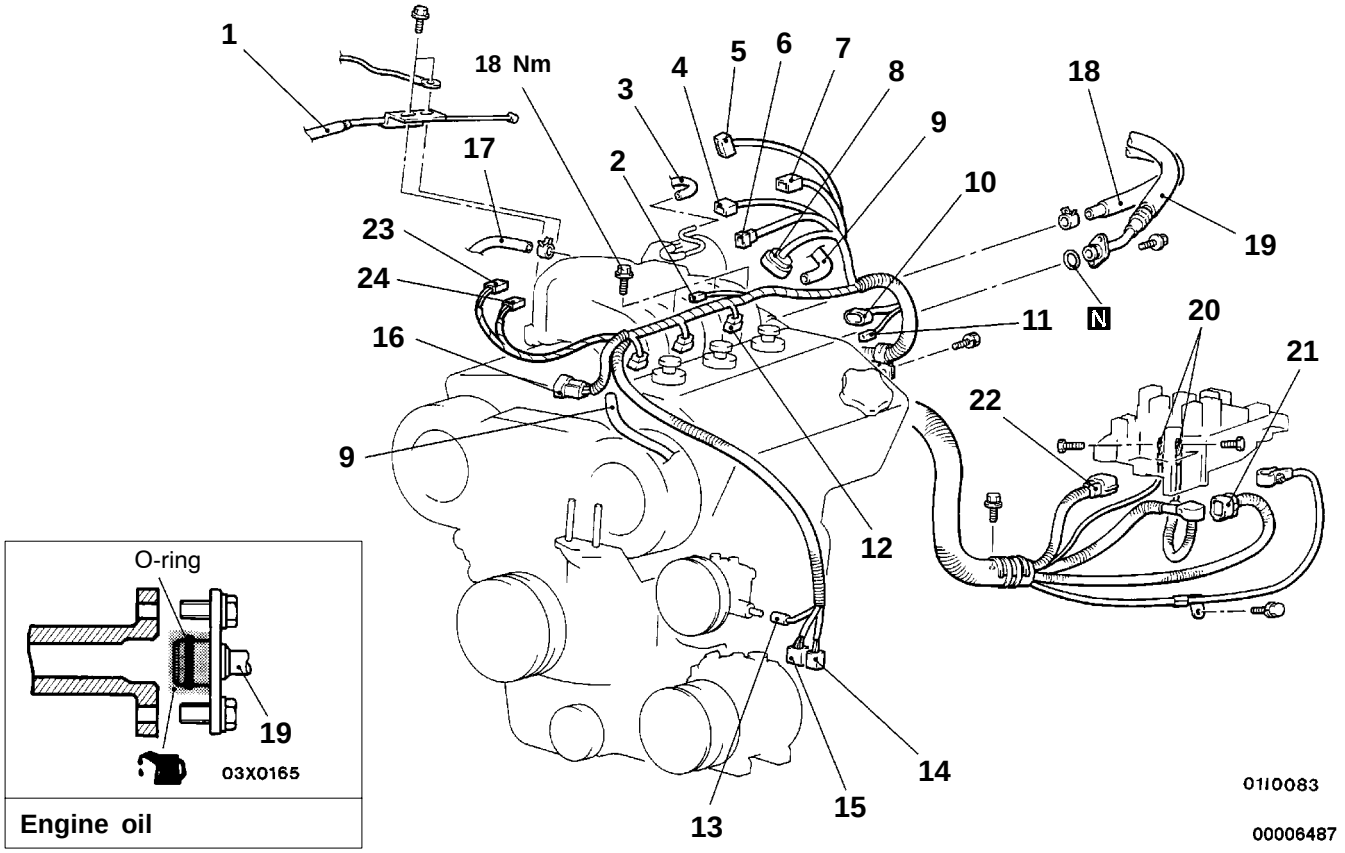
ENGINE ASSEMBLY

11200100558

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Discharge Prevention (Refer to GROUP 13A - On-vehicle Service.)
- Under Cover Removal
- Hood Removal (Refer to GROUP 42.)
- Air Cleaner Removal
- Radiator Removal (Refer to GROUP 14.)
- Front Exhaust Pipe Removal (Refer to GROUP 15.)
- Engine Cover Removal
- Battery Removal
- Engine Coolant Draining

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



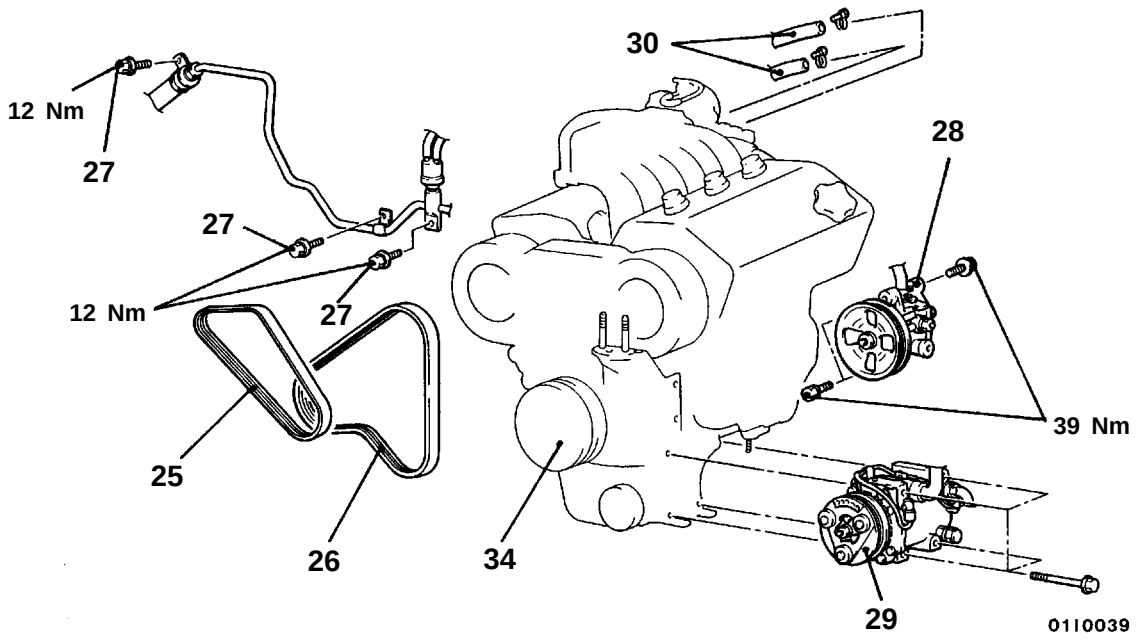
Engine oil

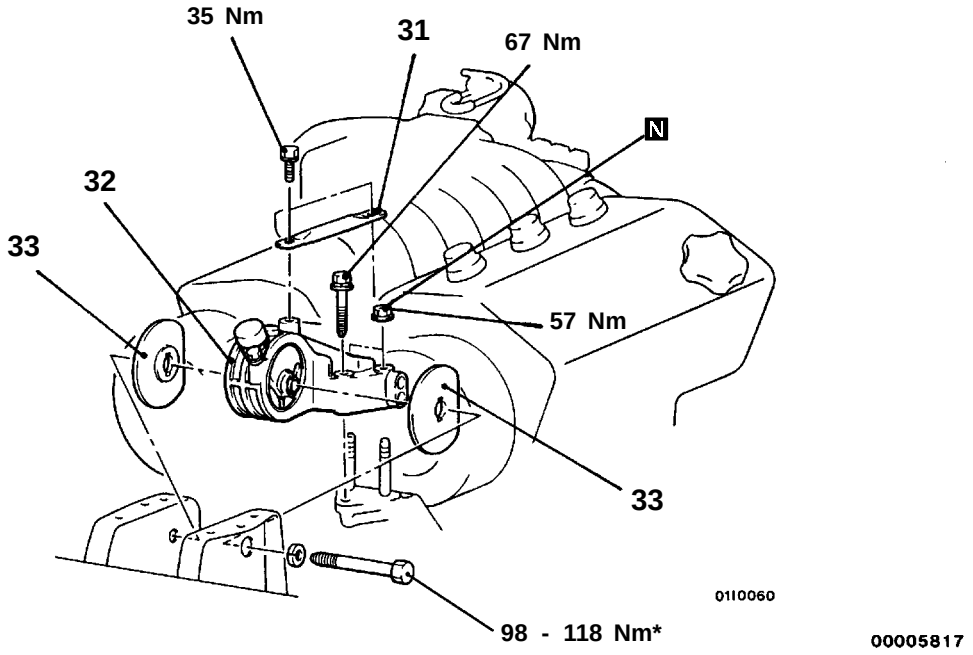
Removal steps

1. Accelerator cable connection
2. Capacitor connector
3. Vacuum hose connection
4. TPS connector
5. Accelerator pedal position sensor connector <TCL>
6. ISC connector
7. Control harness connector
8. Distributor connector
9. Vacuum hose connection
10. Engine coolant temperature sensor connector
11. Engine coolant temperature gauge unit connector
12. Injector connector
13. Power steering oil pressure switch connector
14. Oil pressure harness connector
15. Thermo switch connector
16. Crank angle sensor connector
17. Brake booster vacuum hose connection
18. Fuel return hose connection

▶D◀ 19. High-pressure fuel hose connection

20. Earth cable connection
21. Control harness connector
22. Front harness connector
23. Purge control solenoid valve connector
24. EGR solenoid valve connector





25. Drive belt (Alternator)
26. Drive belt (Power steering and A/C)
27. Clamp bolt (Power steering hose and pipe)
◀A▶ 28. Power steering oil pump assembly
◀B▶ 29. A/C compressor
30. Heater hose connection
◀C▶ • Transmission assembly
31. Engine mount stay
◀D▶ ▶C◀ 32. Engine mount bracket
▶B◀ 33. Engine mount stopper
◀E▶ ▶A◀ 34. Engine assembly

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

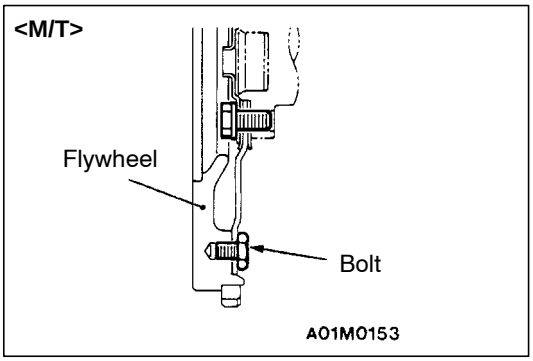
Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

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

◀B▶ A/C COMPRESSOR REMOVAL

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

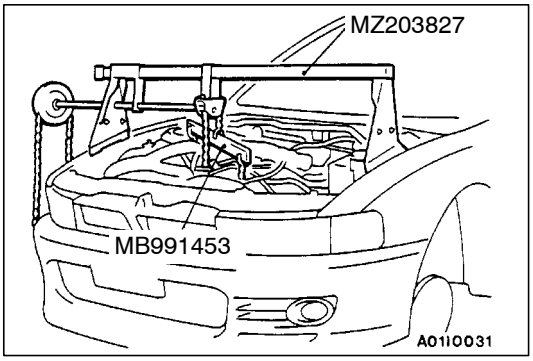
NOTE
Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.



◀C▶ TRANSMISSION ASSEMBLY REMOVAL

<M/T>:
Refer to GROUP 22.

Caution
Do not remove the flywheel mounting bolt shown by the arrow. If this bolt Is removed, the flywheel will become out of balance and damaged.
<A/T>:
Refer to GROUP 23.



◀D▶ 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.

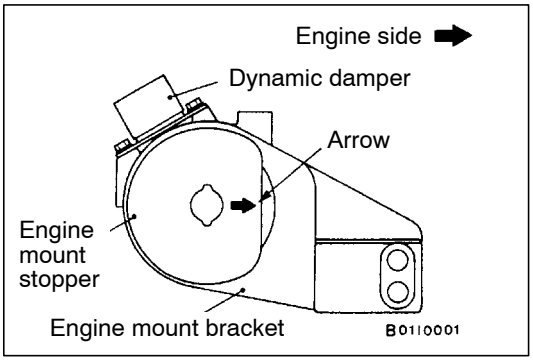
◀E▶ ENGINE ASSEMBLY REMOVAL

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 STOPPER INSTALLATION

Clamp the engine mount stopper so that the arrow points in the direction as shown in the diagram.

▶C◀ ENGINE MOUNT BRACKET INSTALLATION

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

▶D◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

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

NOTES

ENGINE <4D6>

CONTENTS

11109000627

GENERAL INFORMATION

11100010476

Items			4D68
Total displacement mL			1,998
Bore × Stroke mm			82.7 × 93.0
Compression ratio			22.4
Combustion chamber			Vortex chamber type
Camshaft arrangement			SOHC
Number of valve	Intake		4
	Exhaust		4
Valve timing	Intake	Opening	BTDC 20°
		Closing	ABDC 48°
	Exhaust	Opening	BBDC 54°
		Closing	ATDC 22°
Fuel system			Distribution type injection pump
Rocker arm			Roller type
Adjusting screw			Elephant foot type

SERVICE SPECIFICATIONS

11100030502

Items				Standard value	Limit
Alternator drive belt tension	Tension N	When checked		343 - 490	-
		When a used belt is installed		392 - 490	-
		When a new belt is installed		490 - 588	-
	Deflection (Reference value) mm	Centre of belt between alternator pulley and water pump pulley	When checked	8.0 - 10.0	-
			When a used belt is installed	8.0 - 9.4	-
			When a new belt is installed	7.0 - 8.0	-
		Centre of belt between crankshaft pulley and alternator pulley	When checked	7.9 - 9.9	-
			When a used belt is installed	7.9 - 9.2	-
			When a new belt is installed	6.8 - 7.9	-

Items			Standard value	Limit
Power steering oil pump drive belt tension	Tension N	When checked	294 - 490	-
		When a used belt is installed	343 - 441	-
		When a new belt is installed	490 - 686	-
	Deflection mm	When checked	12.6 - 16.3	-
		When a used belt is installed	13.4 - 15.3	-
		When a new belt is installed	10.0 - 12.6	-
A/C compressor drive belt tension	Tension N	When checked	392 - 588	-
		When a used belt is installed	441 - 539	-
		When a new belt is installed	637 - 833	-
	Deflection mm	When checked	9.2 - 12.0	-
		When a used belt is installed	9.8 - 11.2	-
		When a new belt is installed	7.0 - 8.6	-
Valve clearance (at hot) mm		Intake valve	0.35	-
		Exhaust valve	0.45	-
Injection timing (Dial gauge display value mm)			1 ± 0.03 (10°ATDC)	-
Idle speed r/min			800 ± 30	-
Compression pressure kPa			3,500	Min. 2,560
Compression pressure difference of all cylinder (at engine speed of 280 r/min) kPa			-	Max. 300
Cylinder head bolt shank length mm			-	99.4
Timing belt deflection mm			4 - 5	-
Timing belt B deflection mm			5 - 7	-

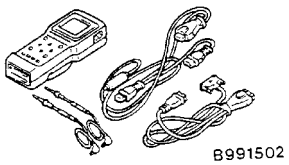
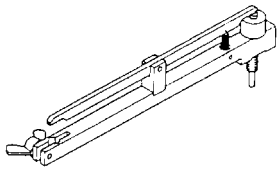
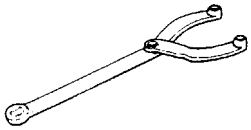
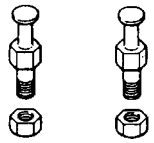
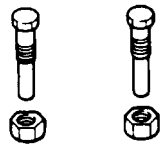
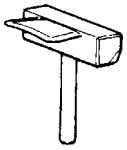
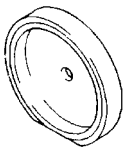
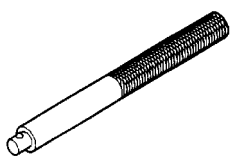
SEALANTS

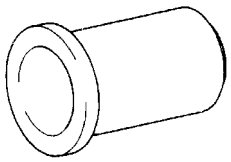
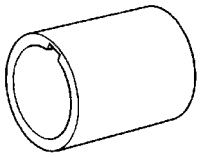
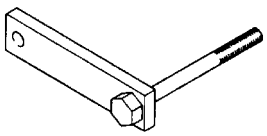
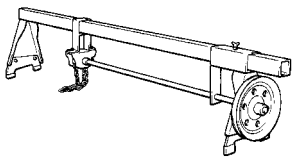
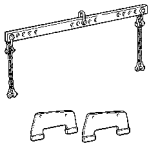
11100050362

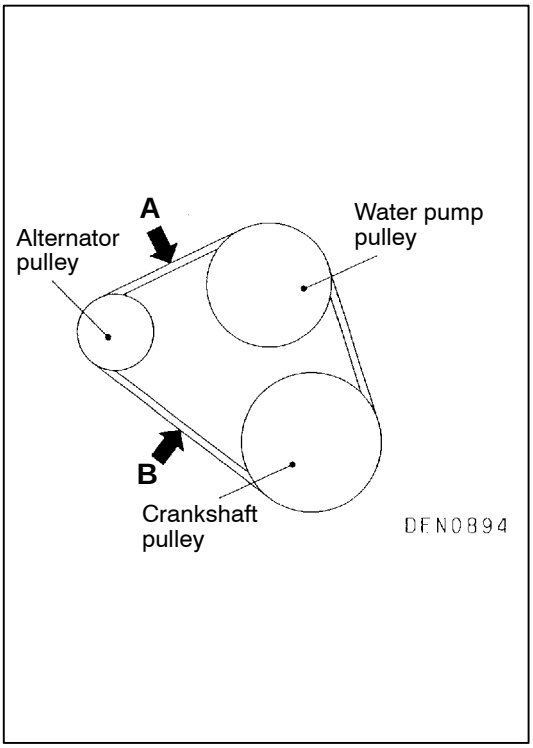
Items	Specified sealants	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Semi-circular packing and rocker cover seal, and cylinder head seal	3M ATD Part No.8660 or equivalent	
Flywheel bolt or adapter plate bolt	3M Stud Locking 4170 or equivalent	-

SPECIAL TOOLS

11100060471

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Idle speed check
	MB998720	Prestroke measuring adapter	Adjustment of the injection timing
	MB990767	End yoke holder	Holding the camshaft sprocket
	MD998719	Crankshaft pulley holder pin	
	MD998754	Crankshaft pulley holder pin	
	MD998364	Camshaft oil seal installer	Installing the camshaft oil seal
	MD998727	Oil pan remover	Removal of oil pan
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	

Tool	Number	Name	Use
	MD998382	Crankshaft front oil seal installer	Installing the crankshaft front oil seal
	MD998383	Crankshaft front oil seal guide	
	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991453	Engine hanger assembly	



ON-VEHICLE SERVICE

11100090449

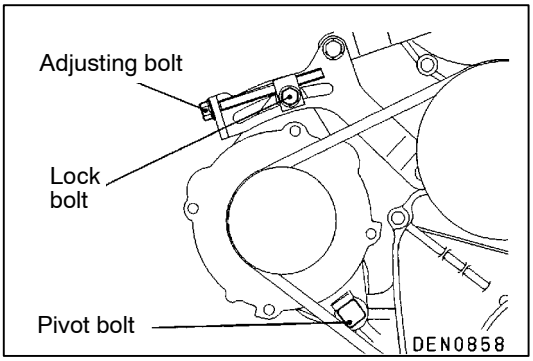
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

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

Standard value:

Tension N		343 - 490
Deflection (Reference value) mm	Portion A	8.0 - 10.0
	Portion B	7.9 - 9.9



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

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

   Standard value:

Items		When a used belt is installed	When a new belt is installed
Tension N		392 - 490	490 - 588
Deflection (Reference value) mm	Portion A	8.0 - 9.4	7.0 - 8.0
	Portion B	7.9 - 9.2	6.8 - 7.9

4. Tighten the lock bolt.

   Tightening torque: 23 Nm

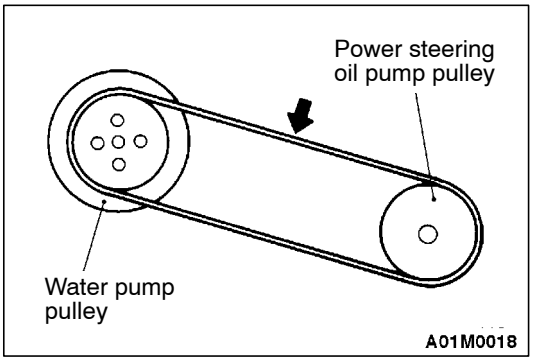
5. Tighten the nut of the alternator pivot bolt.

   Tightening torque: 44 Nm

6. Tighten the adjusting bolt.

   Tightening torque: 10 Nm

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

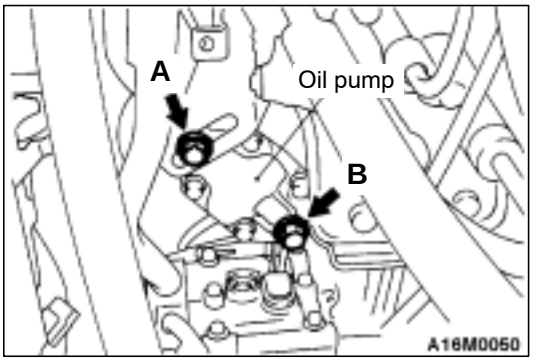


POWER STEERING OIL PUMP DRIVE BELT TENSION CHECK AND ADJUSTMENT 11100110183

1. Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 98 N as shown in the figure. Measure drive belt deflection amount.

   Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Tension N	294 - 490	343 - 441	490 - 686
Deflection (Reference value) mm	12.6 - 16.3	13.4 - 15.3	10.0 - 12.6

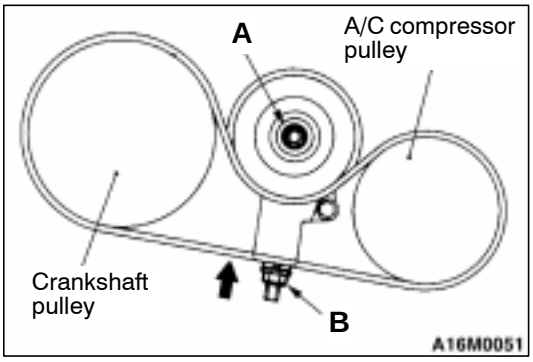


2. If the tension is outside the standard value, adjust by the following procedure.
   (1) Loosen oil pump fixing bolts A and B. Check that the slide bushing at the place where bolt B was installed is touching the A/C bracket and that there is no looseness in the oil pump mounting.
   (2) While holding a bar or similar tool against the oil pump body, apply a suitable amount of force to the belt with your hand to adjust the tension of the belt.
   (3) Tighten oil pump fixing bolts A and B in that order.

   Tightening torque: 39 Nm

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

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



COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

11100100203

1. Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 98 N as shown in the figure. Measure drive belt deflection amount.

   Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Tension N	392 - 588	441 - 539	637 - 833
Deflection (Reference value) mm	9.2 - 12.0	9.8 - 11.2	7.0 - 8.6

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

   Tightening torque: 25 Nm

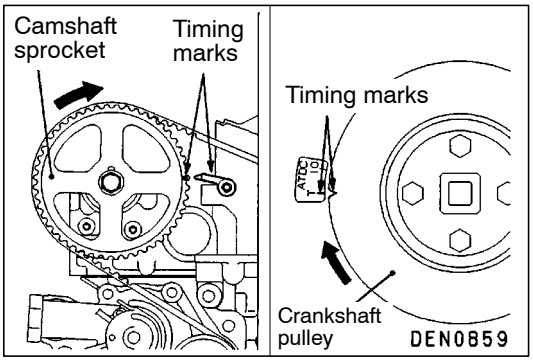
   (4) Check the belt frequency, tension or deflection, and readjust if necessary.

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

VALVE CLEARANCE CHECK AND ADJUSTMENT

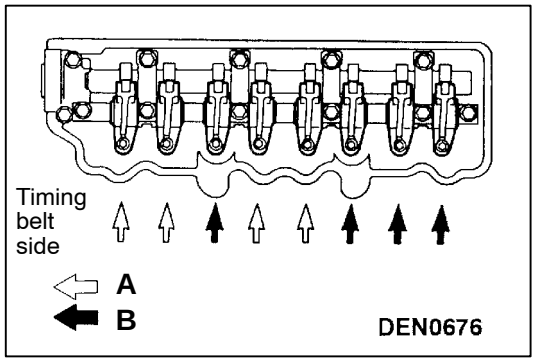
11100150130

1. Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 95 °C.
2. Remove the timing belt upper cover.
3. Remove the rocker cover.
4. Remove the glow plug plate and all of the glow plugs.



5. Turn the crankshaft clockwise to align the crankshaft pulley timing mark and to set the No.1 cylinder or No.4 cylinder to the compression top dead centre position.

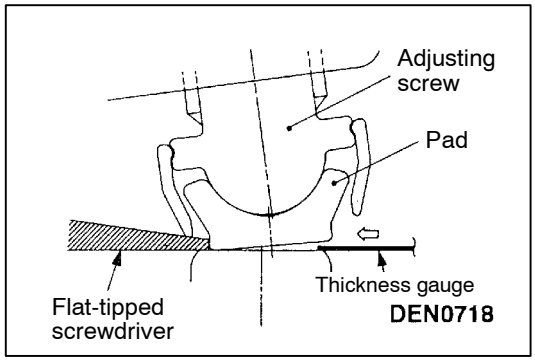
   NOTE
   Aligning the camshaft sprocket timing mark will set the No.1 cylinder to the compression top dead centre position. If the crankshaft is turned one more full revolution from this position, the No.4 cylinder will be set to the compression top dead centre position.



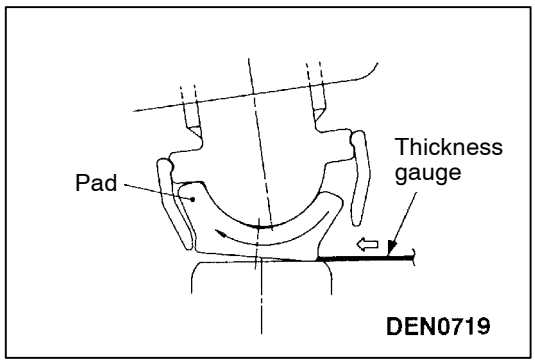
6. Measure the valve clearance in the places indicated by arrows in the illustration.
Arrow A: When the No.1 cylinder is at compression top dead centre
Arrow B: When the No.4 cylinder is at compression top dead centre

Standard value:

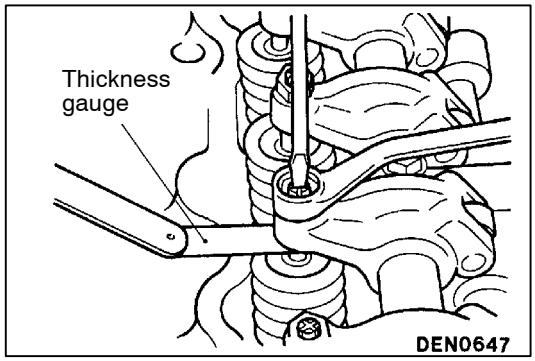
	When warm	When cold (NOTE)
Intake	0.35 mm	0.25 mm
Exhaust	0.45 mm	0.35 mm



NOTE
(1) When inserting the thickness gauge, press the pad from the opposite side using a flat-tipped screwdriver or similar tool to make a gap for the thickness gauge to be inserted.



(2) If you attempt to insert the thickness gauge without using a flat-tipped screwdriver to make a gap, the pad will become tilted as shown in the illustration, and it will not be possible to insert the thickness gauge.



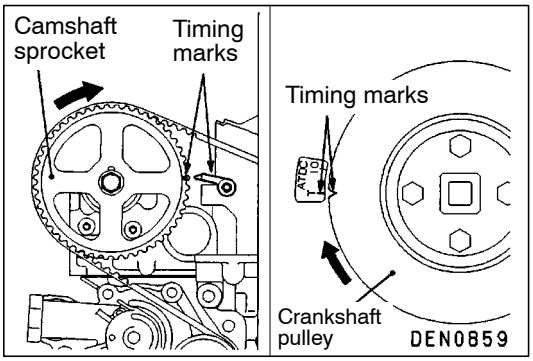
7. If the clearance is outside the standard value, loosen the lock nut and turn the adjusting screw while using a thickness gauge to adjust the clearance.

8. Tighten the lock nut while holding the adjusting screw with a screwdriver so that it doesn't turn.
9. Turn the crankshaft one full revolution to align the crankshaft pulley timing mark.
10. Adjust the remaining valves by the same procedure as in steps 7. - 9. above.
11. Install the glow plugs and the glow plug plate.
12. Install the rocker cover.
13. Install the timing belt upper cover.

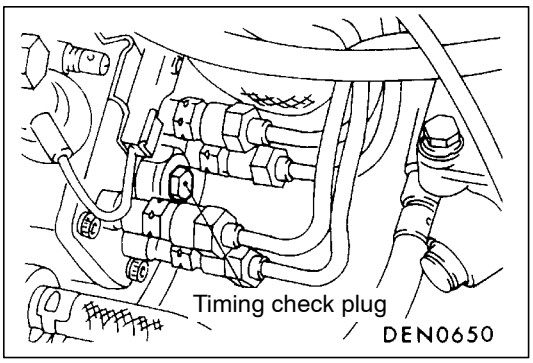
INJECTION TIMING CHECK AND ADJUSTMENT

11100180054

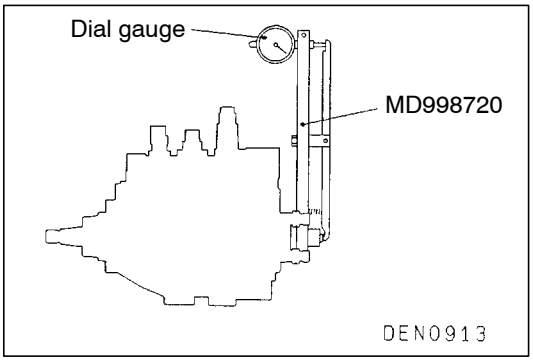
1. Remove all of the glow plugs.
2. Remove the timing belt upper cover.



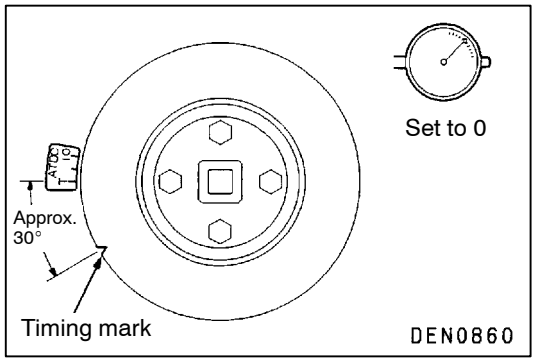
3. Align the timing marks of the camshaft sprocket and set the No.1 cylinder to the top dead centre position.



4. Remove the timing check plug at the rear of the injection pump.

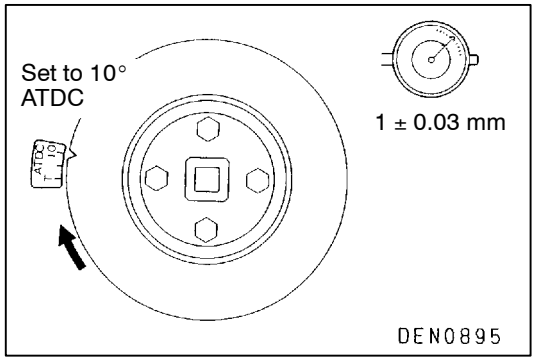


5. Install the special tool to the timing check plug hole at the rear of the injection pump.
6. Connect the dial gauge to the special tool.



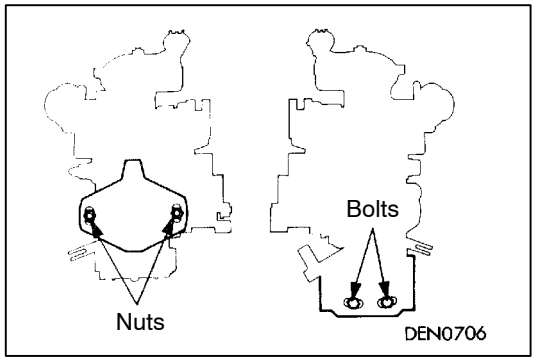
7. Turn the crankshaft clockwise to move the No.1 cylinder approximately 30° before compression top dead centre.
8. Set the needle of the dial gauge to 0.
9. Check that the needle doesn't move even if the crankshaft is turned slightly (2 - 3°) in both clockwise and anti-clockwise direction.

   NOTE
   If the needle moves, the notch is not positioned properly, so once again move the No.1 cylinder approximately 30° before compression top dead centre.



10. Turn the crankshaft clockwise to align the No.1 cylinder to 10° ATDC.
11. Check that the value indicated on the dial gauge is at the standard value.

    Standard value: 1 ± 0.03 mm

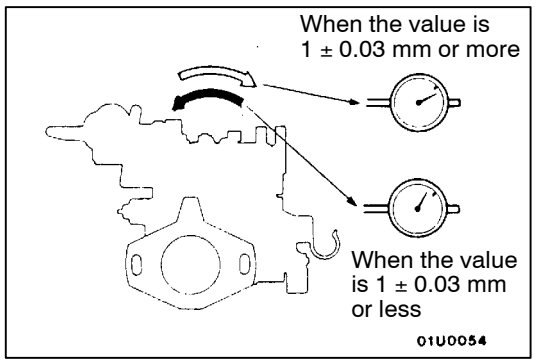


12. If the value is outside the standard value, adjust the injection timing by the following procedure.
    (1) Loosen the injection pipe union nuts (4 places) on the injection pump. (Do not remove the union nuts.)

    Caution
    When loosening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

    (2) Loosen the upper mounting nuts and the lower mounting bolts of the injection pump. (Do not remove the nut and bolt.)
    (3) Tilt the injection pump to the left or right and adjust the needle on the dial gauge so that the display value is uniform.
    (4) Provisionally tighten the mounting nuts and bolts of the injection pump.
    (5) Repeat steps 7 - 12 to check if the adjustment has been made correctly.
    (6) Tighten the mounting nuts and bolts securely.
    (7) Tighten the injection pump union nuts securely.

    Caution
    When tightening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.



13. Remove the special tool.
14. Install a new gasket to the timing check plug.
15. Tighten the timing check plug securely.

IDLE SPEED CHECK

11100350073

NOTE
Check that the injection timing is normal, and then perform this check.

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.
3. Start the engine and check that the idle speed is at the standard value.

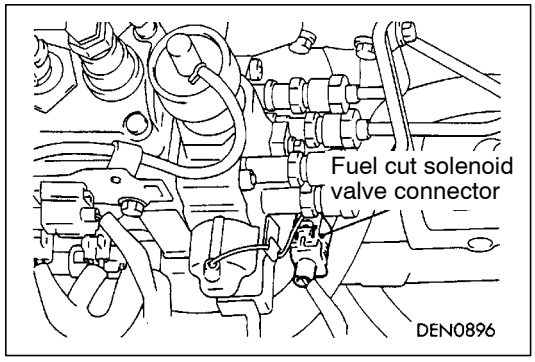
   Standard value: 800 ± 30 r/min

4. If the idle speed is not at the standard value, refer to GROUP 13E - Troubleshooting.

COMPRESSION PRESSURE CHECK

11100260505

1. Before inspection, check that the engine oil, starter motor and battery are normal. In addition, set the vehicle to the pre-inspection condition.
2. Remove the glow plug plate and all of the glow plugs.

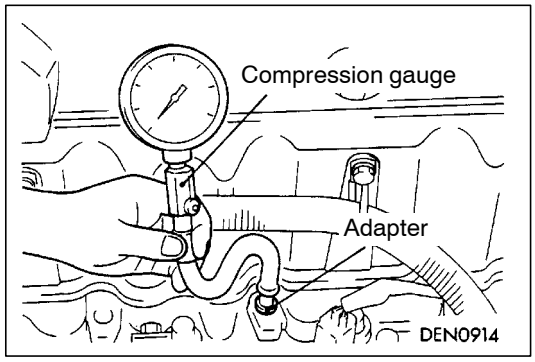


3. Disconnect the fuel cut solenoid valve connector.

   NOTE
   Doing this will prevent carrying out fuel injection.

4. Cover the glow 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 glow 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 glow plug hole, which is dangerous.



5. Set compression gauge to one of the glow plug holes.
6. Crank the engine and measure the compression pressure.

   Standard value:
   3,500 kPa (at engine speed of 280 r/min)

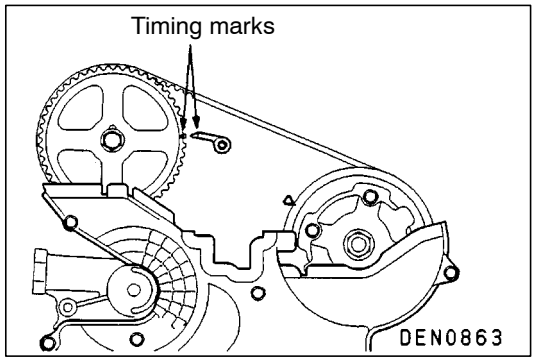
   Limit: Min. 2,560 kPa (at engine speed of 280 r/min)
7. Measure the compression pressure for all cylinders, and check that the pressure differences of the cylinders are below the limit.

   Limit: Max. 300 kPa
8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the glow plug hole, and repeat the operations in steps 6 and 7.
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the fuel cut solenoid valve connector.
10. Install the glow plugs and the glow plug plate.

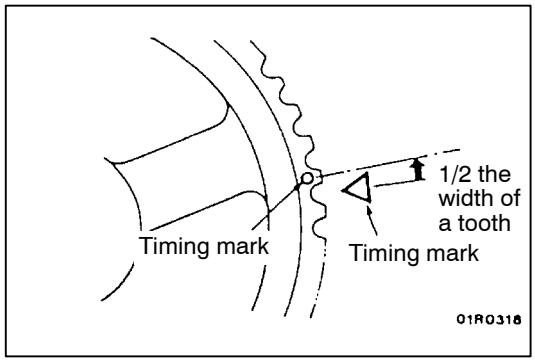
TIMING BELT TENSION ADJUSTMENT 11100280174

There are two timing belts: one is the timing belt for the valve timing, and the other is the timing belt B for driving the right-side counterbalance shaft.

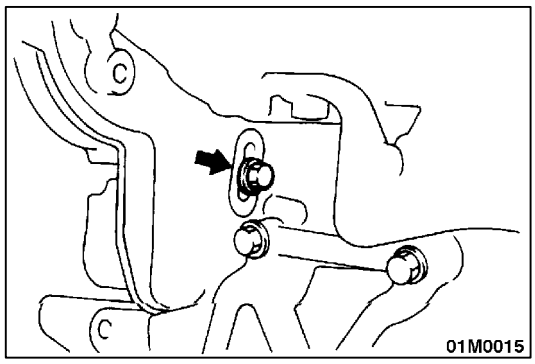
1. Remove the timing belt upper cover.
2. Remove the glow plug plate and all of the glow plugs.



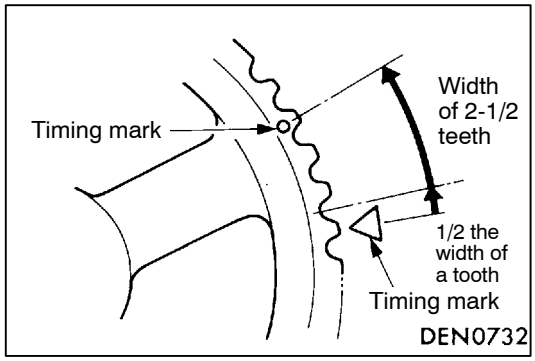
3. Turn the crankshaft clockwise and check that there is nothing wrong with the timing belt. Replace the belt if necessary.
4. Turn the crankshaft clockwise to set the No.1 cylinder to the compression top dead centre position.



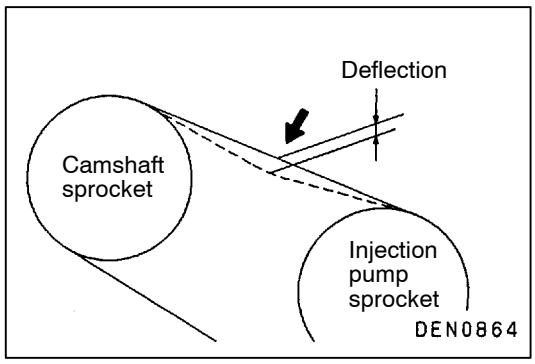
5. Turn the crankshaft anti-clockwise by 1/2 the width of a camshaft sprocket tooth in order to take up the slack in the idler pulley belt (the side where the belt is slack).



6. Loosen the timing belt tensioner mounting bolt by 1/4 - 1/3 a turn, and use the force of the tensioner spring to apply tension to the belt.



7. Turn the crankshaft anti-clockwise again by the width of three camshaft sprocket teeth.



8. Securely tighten the timing belt tensioner mounting bolt.
9. Turn the crankshaft clockwise to align the timing mark.
10. Press the belt at the point between the camshaft sprocket and the injection pump sprocket with your index finger to check the belt deflection.

    Standard value: 4.0 - 5.0 mm

11. Install the timing belt upper cover.
12. Install the glow plugs and the glow plug plate.

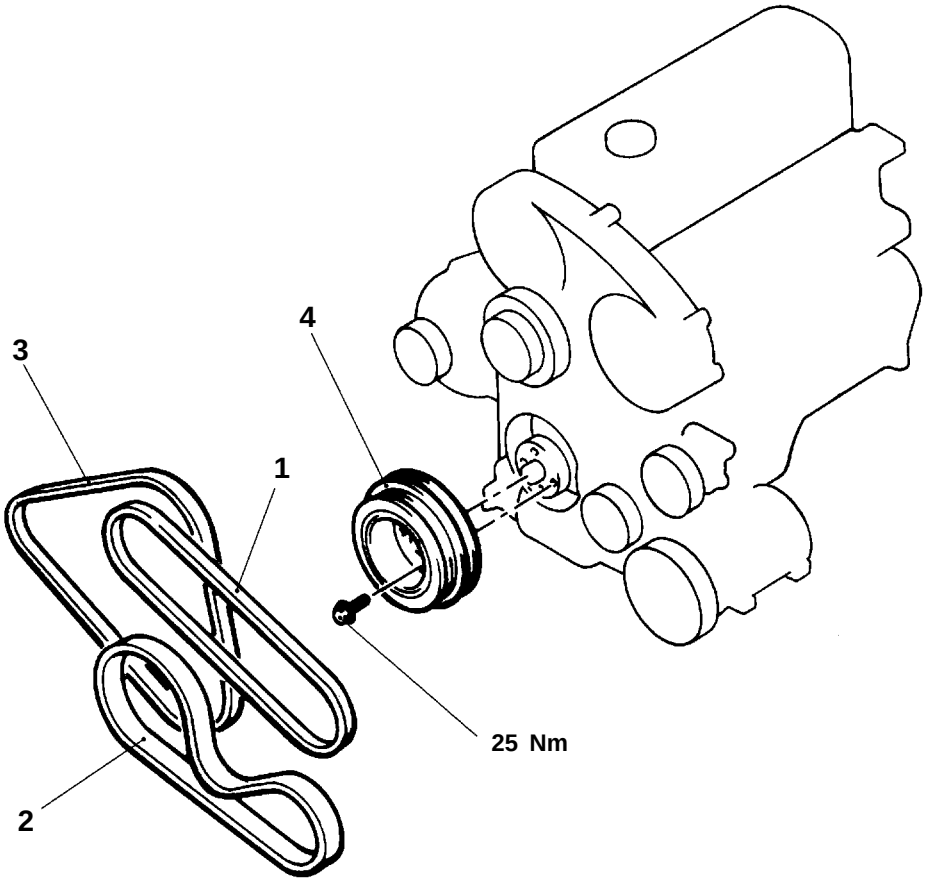
CRANKSHAFT PULLEY

11200160327

REMOVAL AND INSTALLATION

Pre-removal Operation
- Under Cover Removal

Post-installation Operation
- Drive Belt Tension Adjustment (Refer to P.11C-6.)
- Under Cover Installation



A01M0019

Removal steps

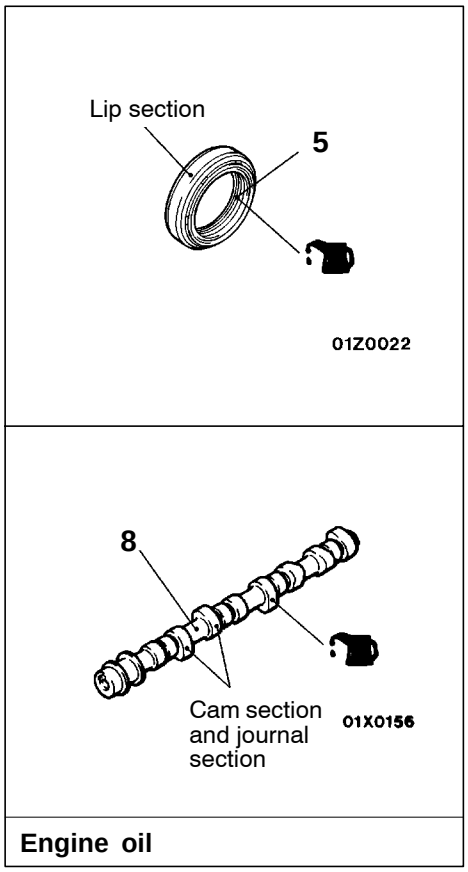
1. Drive belt (Power steering)
2. Drive belt (A/C)
3. Drive belt (Alternator)
4. Crankshaft pulley

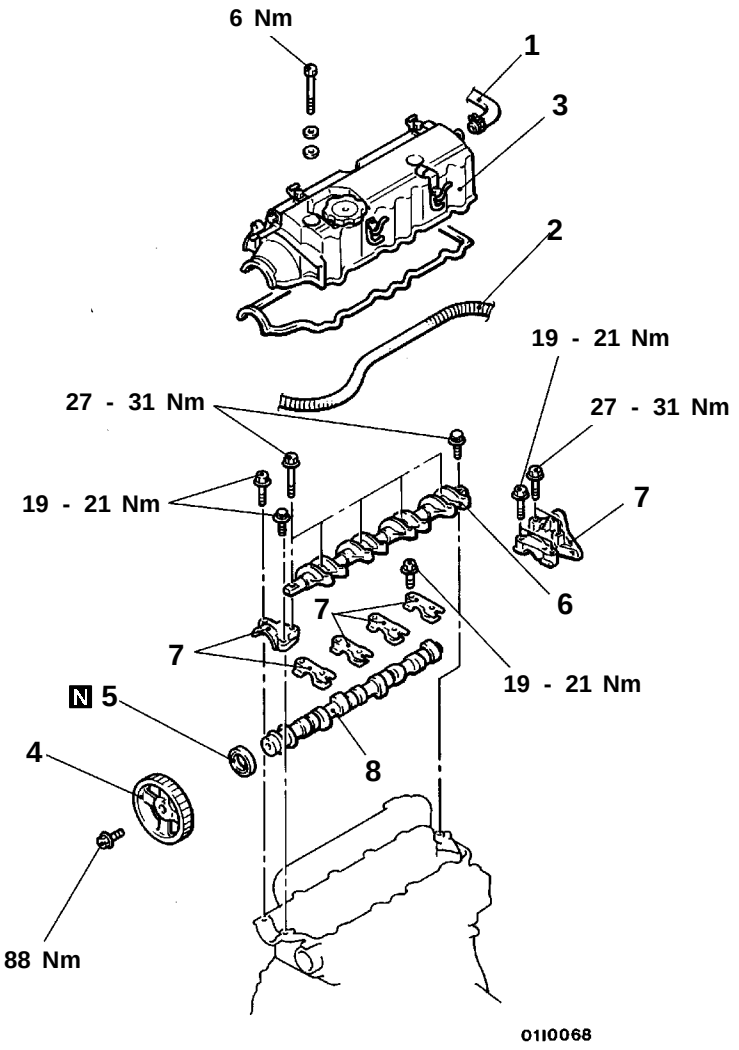
CAMSHAFT AND CAMSHAFT OIL SEAL

11200190425

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation (Refer to P.11C-26.)
- Air Pipe A Removal and Installation
- Vacuum Pump Removal and Installation (Refer to GROUP 14.)

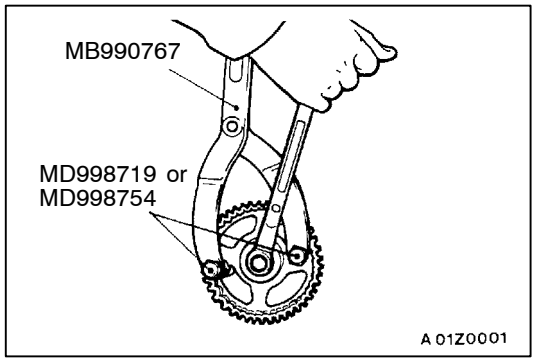




00006488

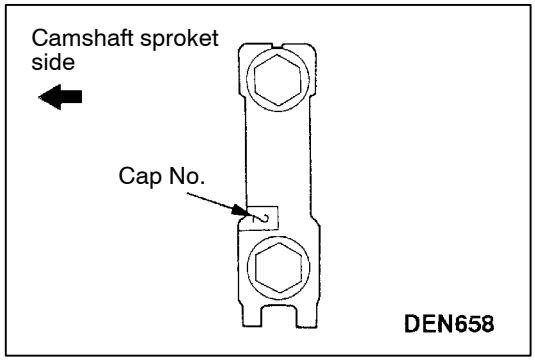
Removal steps

1. Breather hose connection
2. Control harness
3. Rocker cover
◀A▶ ▶D◀ 4. Camshaft sprocket
▶C◀ 5. Camshaft oil seal
▶B◀ 6. Rocker arm and shaft assembly
▶A◀ 7. Camshaft bearing cap
8. Camshaft



REMOVAL SERVICE POINT

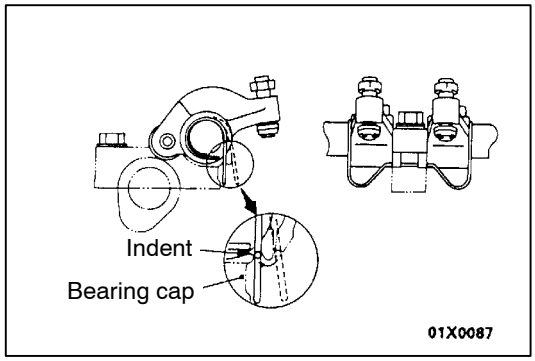
◀A▶ CAMSHAFT SPROCKET REMOVAL



INSTALLATION SERVICE POINTS

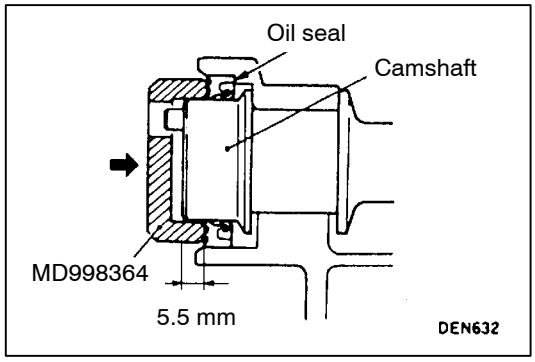
▶A◀ CAMSHAFT BEARING CAP INSTALLATION

The cap numbers are embossed on the top surface of the bearing caps, so install in the order of the numbers. However, no numbers are embossed on bearing caps 1 and 5.



▶B◀ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. Install the rocker arm and shaft assembly to the bearing caps.
2. Set the rocker arm springs into the bearing cap indents.
3. Check the valve clearance and adjust if necessary. (Refer to P.11C-8.)



▶C◀ CAMSHAFT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip and camshaft.
2. Use the special tool to tap in the oil seal.

   NOTE
   The oil seal should be tapped in until the distance from the end of the camshaft to the end of the oil seal is as shown in the illustration.

▶D◀ 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.

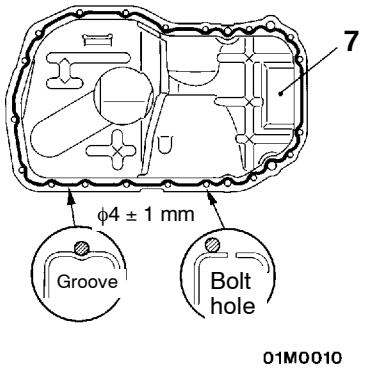
Tightening torque: 88 Nm

OIL PAN

11200280221

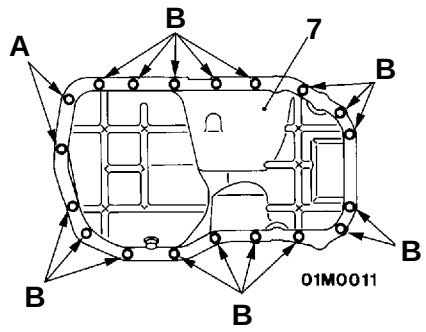
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Engine Oil Level Gauge Removal and Insertion
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)

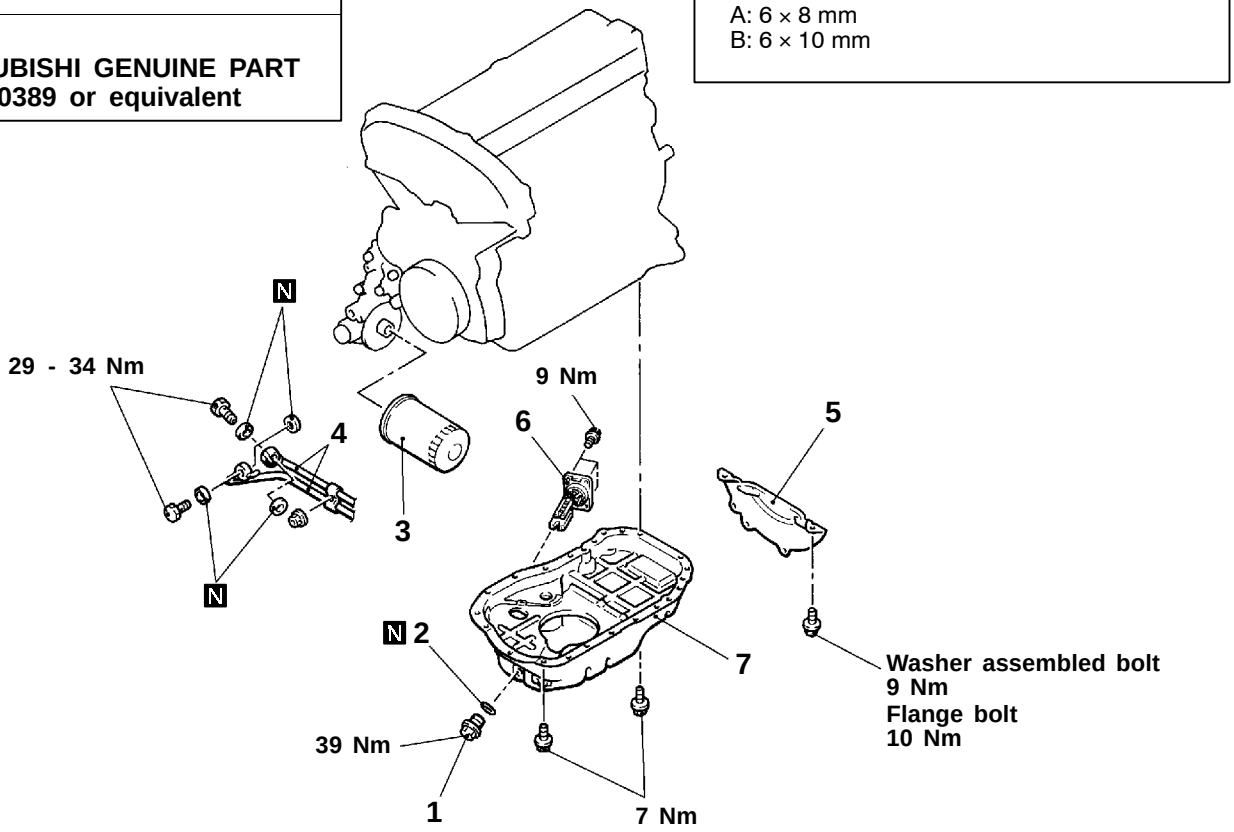


Sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent

BOLT IDENTIFICATION



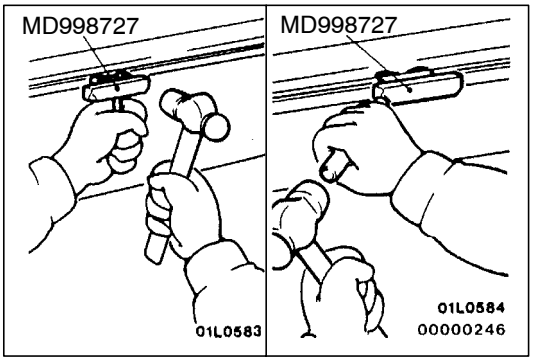
A: 6 × 8 mm
B: 6 × 10 mm



01I0069
00006489

Removal steps

▶A◀ 1. Drain plug
▶A◀ 2. Drain plug gasket
▶A◀ 3. Oil filter
4. Engine oil cooler pipe connection
5. Bell housing cover
6. Oil level sensor
◀A▶ 7. Oil pan

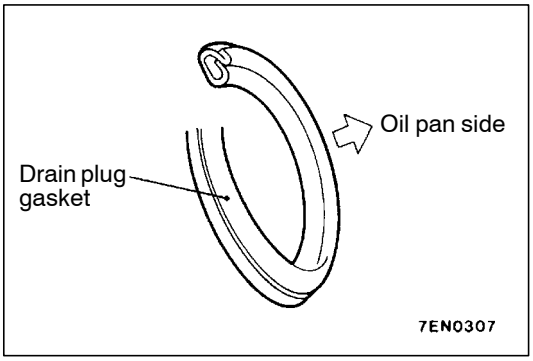


REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

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

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



INSTALLATION SERVICE POINT

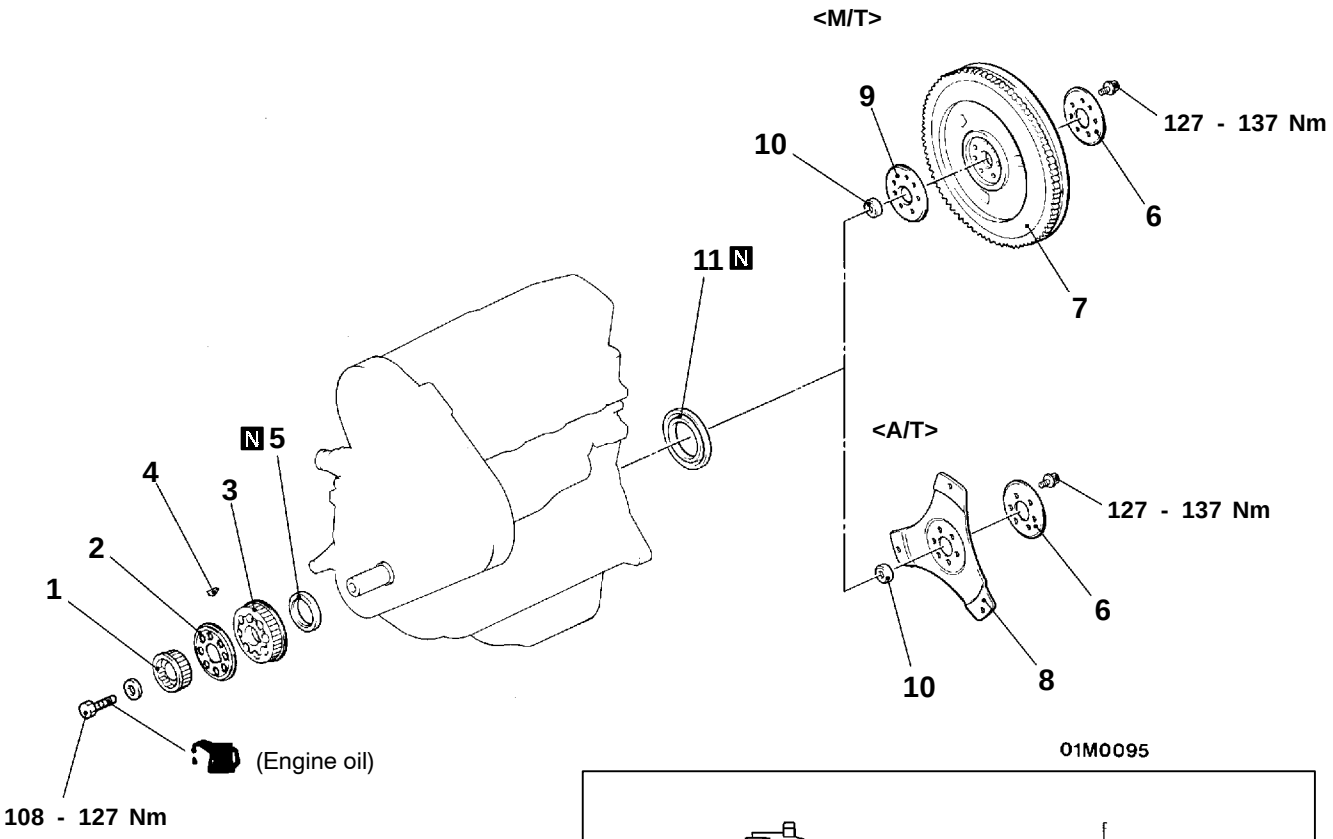
▶A◀ DRAIN PLUG GASKET INSTALLATION

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

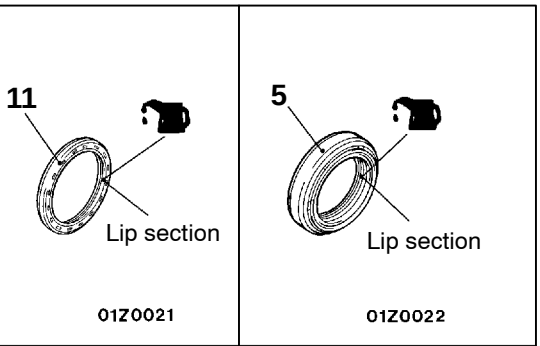
CRANKSHAFT OIL SEAL

11200310159

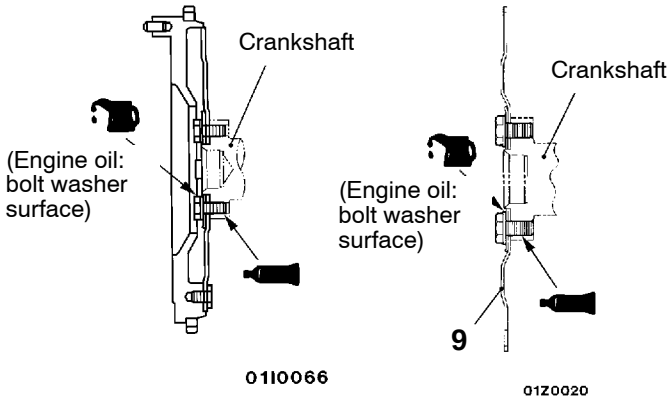
REMOVAL AND INSTALLATION



01M0095



Engine oil



Sealant: 3M Stud Locking 4170 or equivalent

00006490

Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11C-26.)
- Crank angle sensor (Refer to GROUP 16.)

1. Crankshaft sprocket
2. Flange
3. Crankshaft sprocket B
4. Key

▶C◀ 5. Crankshaft front oil seal

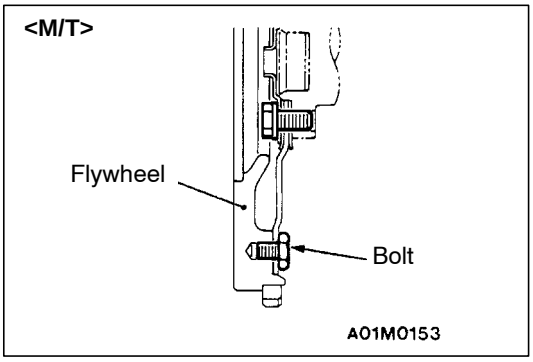
Crankshaft rear oil seal removal steps

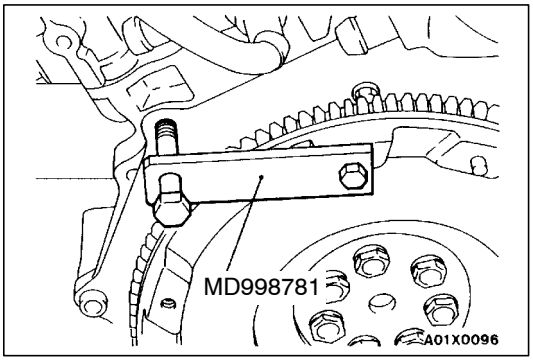
◀A▶
- Transmission assembly
- Clutch cover and disc <M/T>

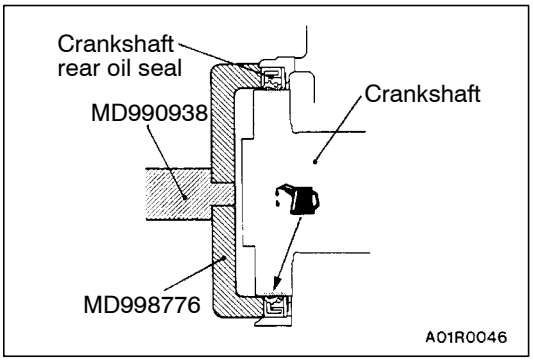
◀B▶ ▶B◀ 6. Adapter plate
◀B▶ ▶B◀ 7. Flywheel <M/T>
◀B▶ ▶B◀ 8. Drive plate <A/T>
◀B▶ ▶B◀ 9. Adapter plate <M/T>

10. Crankshaft bushing

▶A◀ 11. Crankshaft rear oil seal







REMOVAL SERVICE POINT

◀A▶ TRANSMISSION ASSEMBLY REMOVAL

<M/T>:
Refer to GROUP 22.

Caution
Do not remove the flywheel mounting bolt shown by the arrow. If this bolt Is removed, the flywheel will become out of balance and damaged.

<A/T>:
Refer to GROUP 23.

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

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

INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

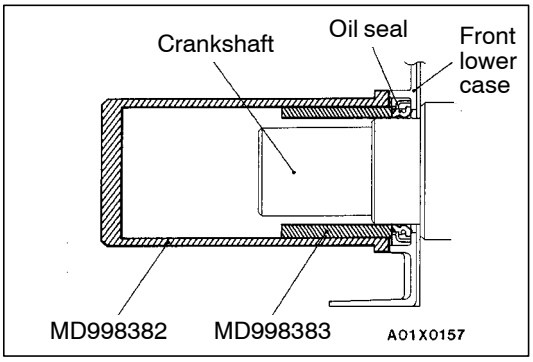
1. Apply a small mount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

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

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

   Specified sealant: 3M Stud locking 4170 or equivalent

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



▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

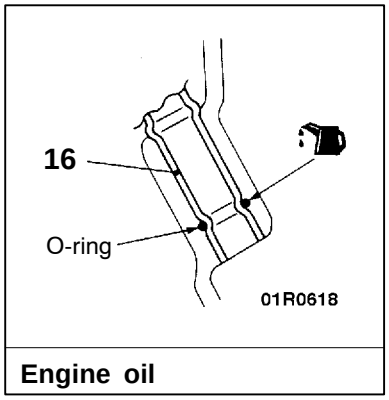
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap the oil seal unit it is flush with the oil seal case.

CYLINDER HEAD GASKET

11200400566

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Air Pipe A Removal and Installation (Refer to GROUP 15 - Intercooler.)
- Vacuum Pump Removal and Installation (Refer to GROUP 14.)
- Timing Belt Removal and Installation (Refer to P.11C-26.)
- Thermostat Case Assembly Removal and Installation (Refer to GROUP 14 - Water Hoses and Pipes.)



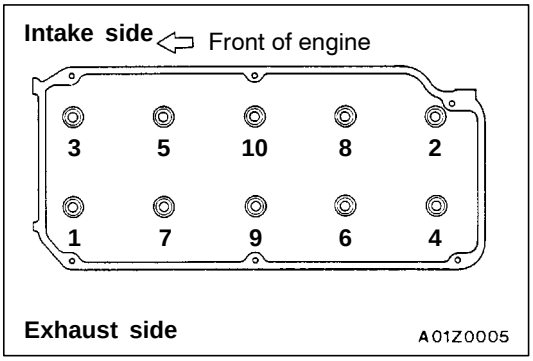
Removal steps

1. Breather hose connection
2. Control harness
3. Rocker cover
◀A▶ ▶D◀ 4. Fuel injection pipe
5. Camshaft bearing cap
6. Glow plug plate
▶C◀ 7. Rocker arm and shaft assembly
8. Fuel return hose connection
9. Water temperature sensor connector
10. Vacuum air temperature sensor connector
11. Engine coolant temperature gauge unit connector
12. Brake booster vacuum hose connection
13. Timing belt rear centre cover
14. Front exhaust pipe connection
15. Oil return pipe connection
16. Oil level gauge guide assembly
17. Alternator brace
◀B▶ ▶B◀ 18. Cylinder head bolt
19. Cylinder head assembly
▶A◀ 20. Cylinder head gasket

◀A▶ FUEL INJECTION PIPE REMOVAL

When loosening nuts at injection pipe ends, hold the nut at other side (delivery holder nut for pump side, nozzle holder nut at nozzle side) with wrench.

Caution
After disconnecting the injection pipe, plug the opening so that no foreign particles get inside the pump or into the injection nozzle.



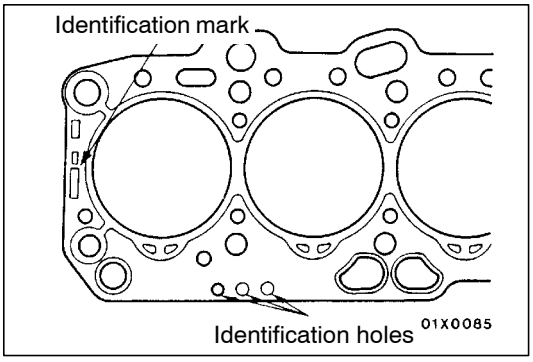
◀B▶ CYLINDER HEAD BOLT REMOVAL

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

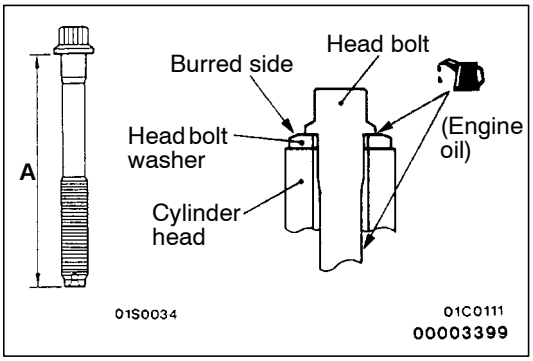
INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

1. Wipe off all oil and grease from the gasket mounting surface.

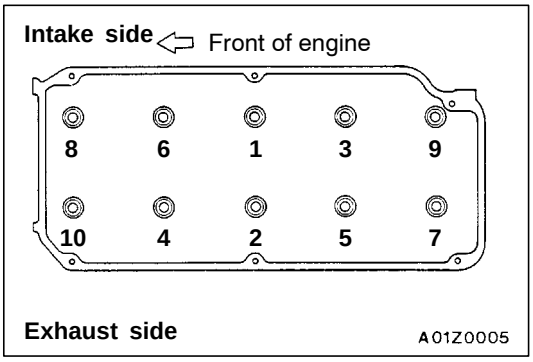


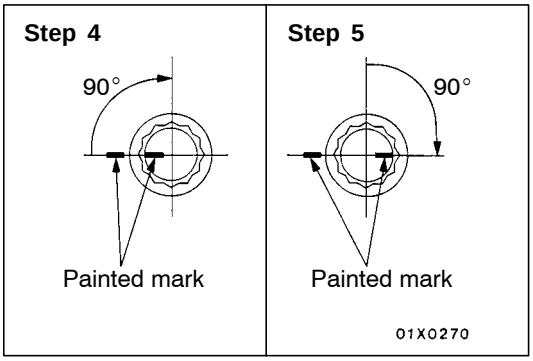
2. Check the number of identification holes on the cylinder head gasket that was removed, and select a cylinder head gasket with the same number of identification holes.
3. Place the cylinder head gasket on top of the cylinder block so that the identification mark is facing upwards as shown in the illustration.



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

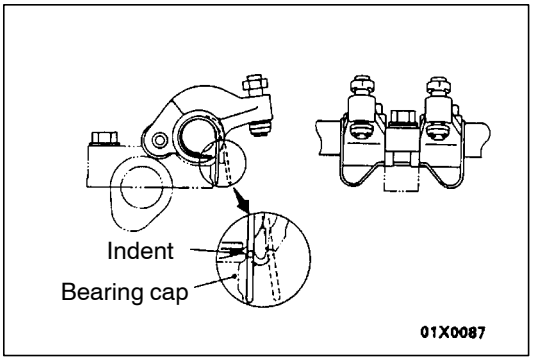




4. Tighten the bolts by the following procedure.

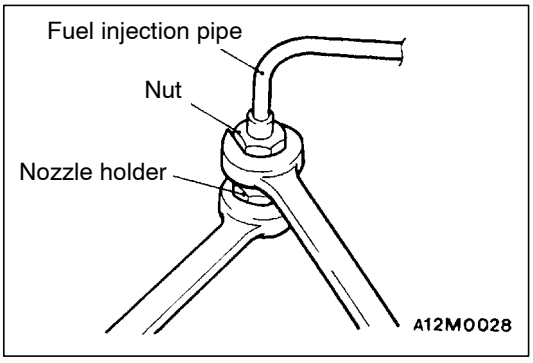
Step	Operation	Remarks
1	Tighten to 88 Nm.	Carry out in the order shown in the illustration.
2	Fully loosen.	Carry out in the reverse order of that shown in the illustration.
3	Tighten to 39 Nm.	Carry out in the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. 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◀ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. Install the rocker arm and shaft assembly to the bearing caps.
2. Set the rocker arm springs into the bearing cap indents.
3. Check the valve clearance and adjust if necessary. (Refer to P.11C-8.)



▶D◀ FUEL INJECTION PIPE INSTALLATION

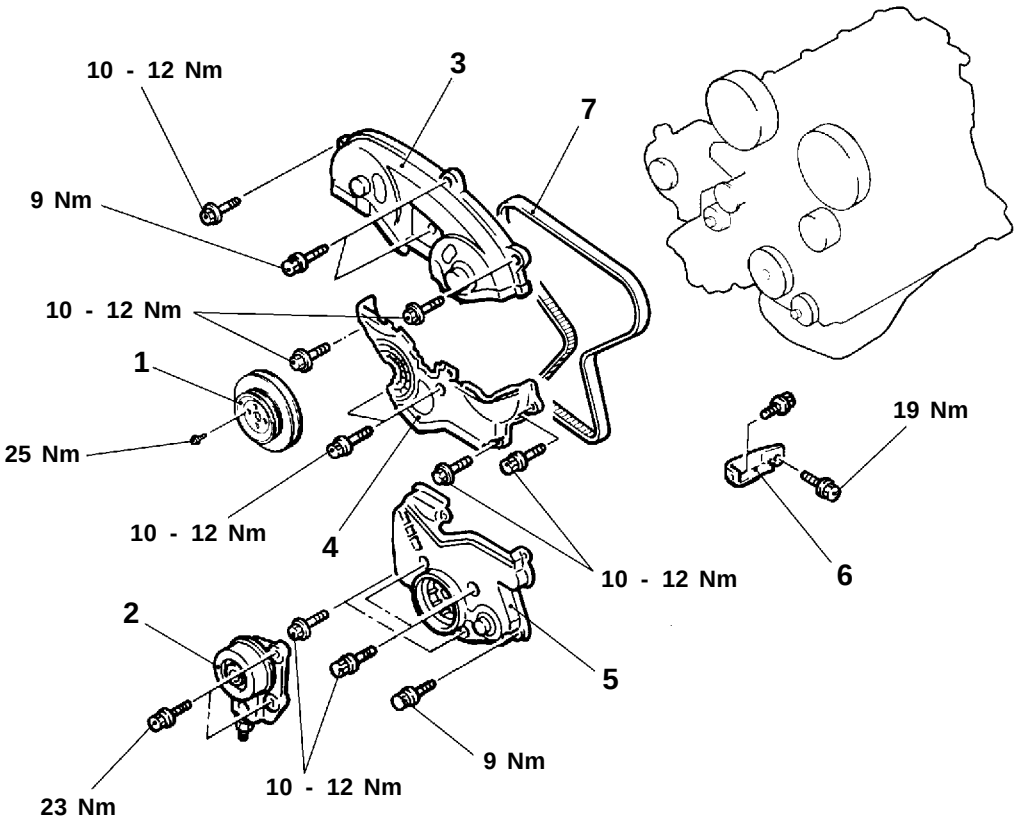
When tightening the nuts at both ends of the fuel injection pipe, hold the delivery holder (for pump side) and the fuel injection nozzle assembly (for nozzle side) with a wrench, and tighten the nuts to the specified torque.

TIMING BELT

11200430497

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Crankshaft Pulley Removal and Installation (Refer to P.11C-15.)
- Engine Mount Bracket Removal and Installation (Refer to GROUP 32.)

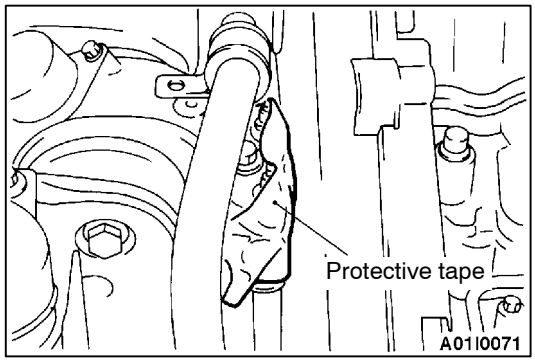


A01I0090

Removal steps

1. Water pump pulley
2. A/C tension pulley assembly
3. Timing belt front upper cover
4. Timing belt front centre cover
5. Timing belt front lower cover
6. Injection pump bracket stay
- Timing belt tension adjustment
7. Timing belt

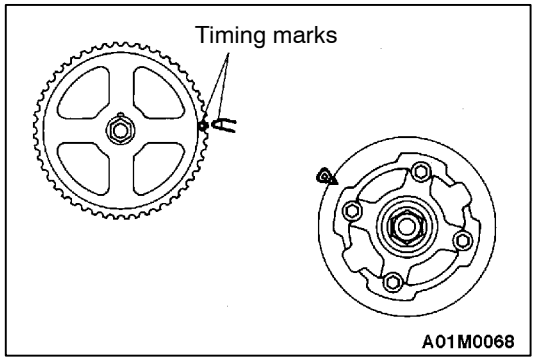
◀A▶ ▶B◀ ◀B▶ ▶A◀



REMOVAL SERVICE POINTS

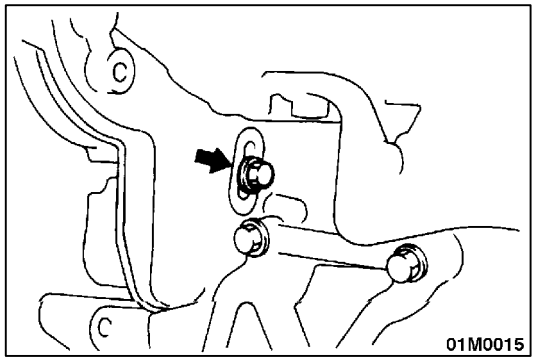
◀A▶ TIMING BELT FRONT UPPER COVER INSTALLATION

Attach protective tape to the engine mount bracket, and then remove the timing belt front upper cover.

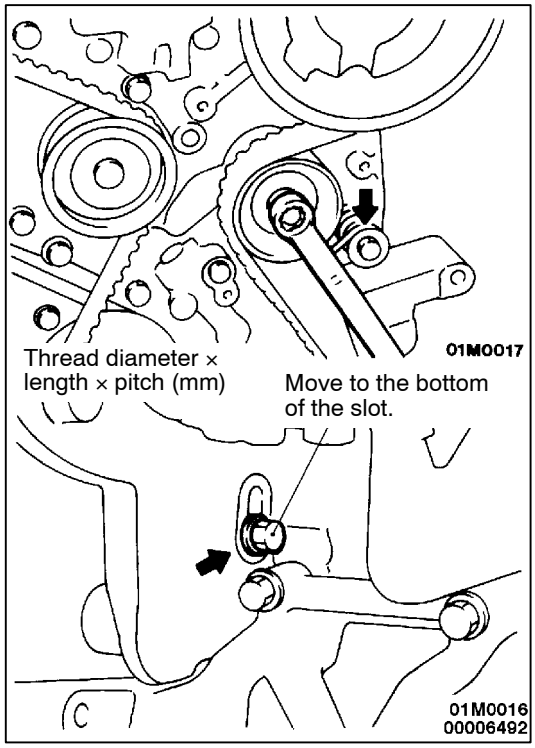


◀B▶ TIMING BELT REMOVAL

1. Align the timing marks.

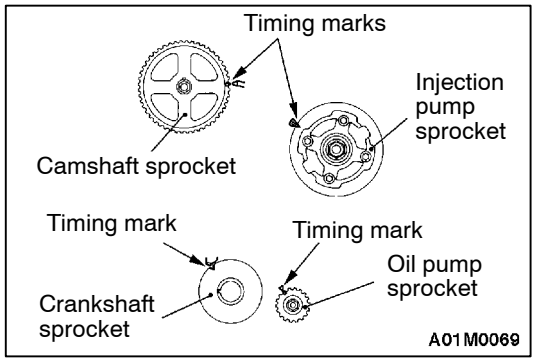


2. Loosen the installation bolt of the timing belt tensioner.



3. Move the timing belt tensioner downward and loosely tighten the bolt so that the tensioner doesn't return; then remove the timing belt.

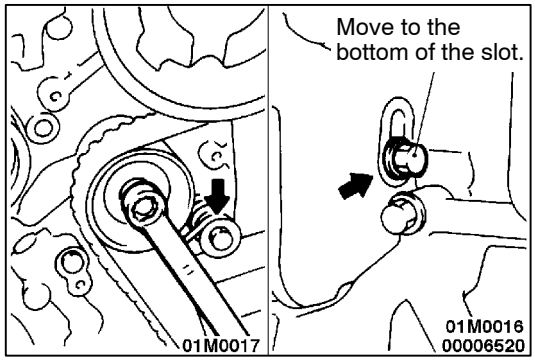
Caution
If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT INSTALLATION

1. Ensure that the timing marks of the camshaft sprocket, the injection pump sprocket, the crankshaft sprocket, and the oil pump sprocket are all aligned.

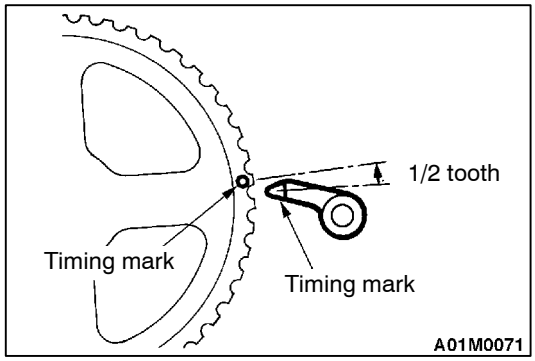


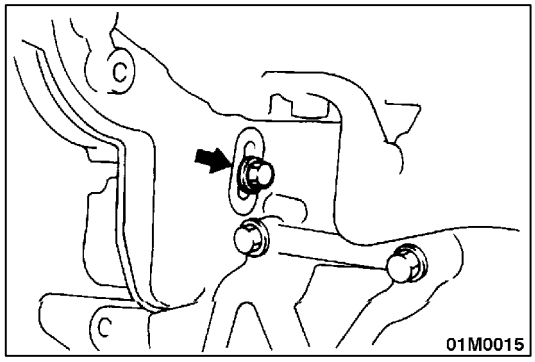
2. Move the timing belt tensioner downward and loosely tighten the bolt so that the tensioner doesn't return.
3. Install the timing belt onto the crankshaft sprocket, the timing belt idler, the camshaft sprocket, the injection pump sprocket, and the oil pump sprocket in that order.

Caution
If the timing belt is reused, install so that the arrow marked on it at the time of removal is pointing in the clockwise direction.

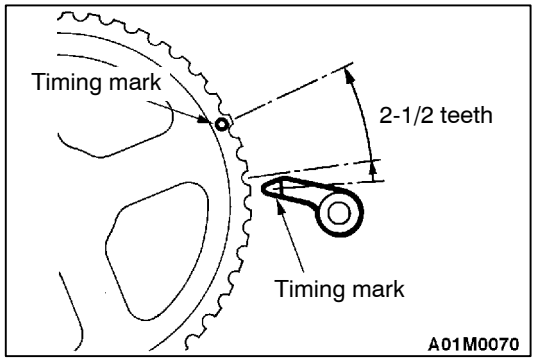
▶B◀ TIMING BELT TENSION ADJUSTMENT

1. Turn the crankshaft anti-clockwise by a distance equivalent to 1/2 tooth of the camshaft sprocket in order to correct looseness at the timing belt idler side.



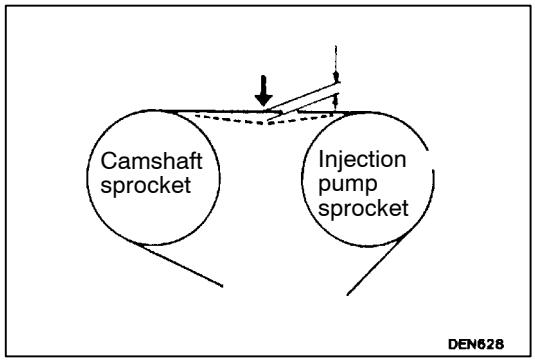


2. Loosen (by 90° to 120° turn) the tensioner installation bolt previously secured provisionally, taking advantage of the force of the tensioner spring to provide tension to the belt.



3. In addition, turn the crankshaft anti-clockwise by a distance equivalent to 2-1/2 teeth.
4. Tighten the timing belt tensioner to the specified torque.

   Tightening torque: 48 Nm
5. Turn the crankshaft clockwise and align the timing mark.



6. Using the index finger, press between the camshaft sprocket and the injection pump sprocket, and check whether or not the amount of flexion is within the standard value range.

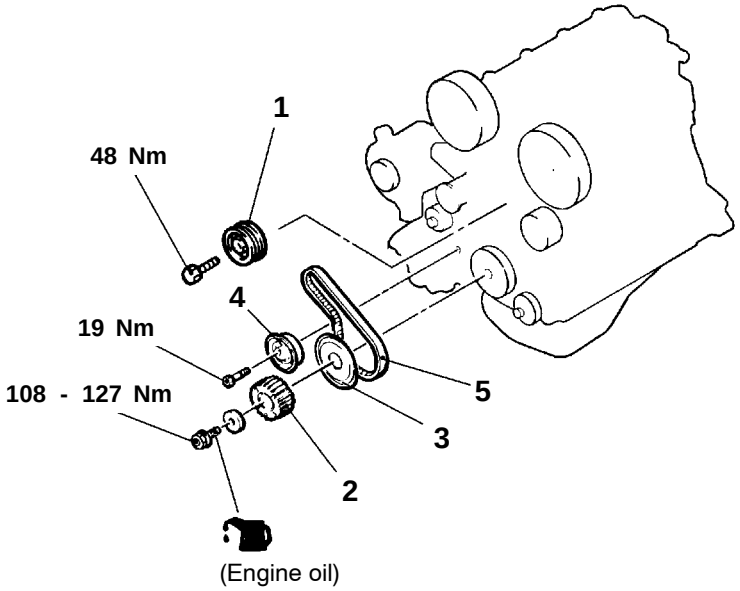
Standard value: 4 - 5 mm

TIMING BELT B

11200460113

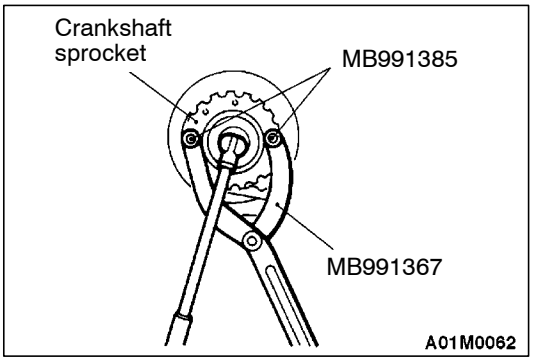
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Crankshaft Pulley Removal and Installation (Refer to P.11C-15.)
- Engine Mount Bracket Removal and Installation (Refer to GROUP 32.)
- Timing Belt Removal and Installation (Refer to P.11C-26.)



Removal steps

1. Idler pulley
◀A▶ ▶B◀ 2. Crankshaft sprocket
3. Flange
4. Timing belt tensioner
◀B▶ ▶A◀ 5. Timing belt B

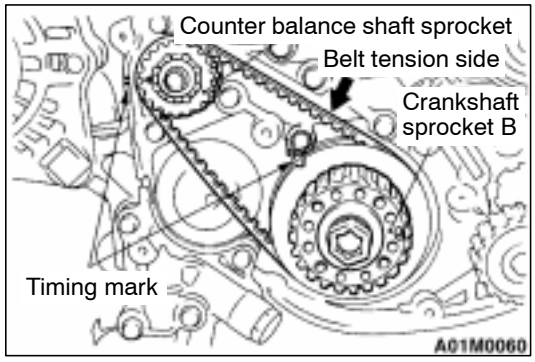


REMOVAL SERVICE POINTS

◀A▶ CRANKSHAFT SPROCKET REMOVAL

◀B▶ TIMING BELT B REMOVAL

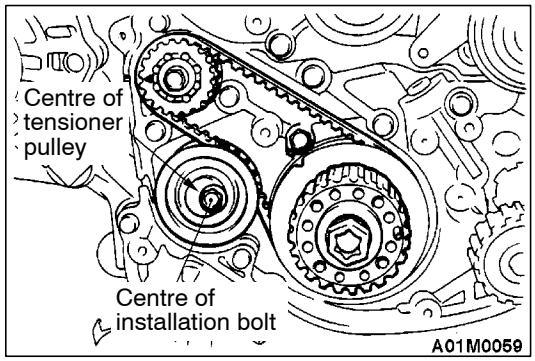
Caution
If the timing belt "B" is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



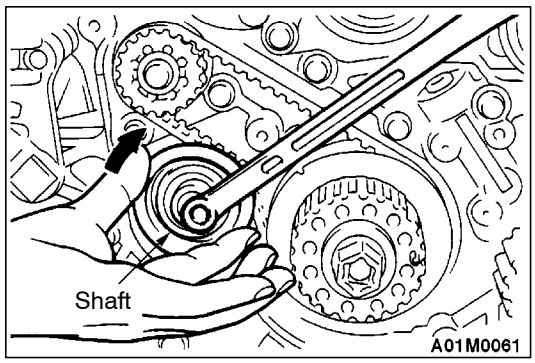
INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT B INSTALLATION

1. Install the timing belt "B" by the following procedure.
   (1) Ensure that crankshaft sprocket "B" timing mark and the counterbalance shaft sprocket timing mark are aligned.
   (2) Fit timing belt "B" over crankshaft sprocket "B" and the counterbalance shaft sprocket. Ensure that there is no slack in the belt.

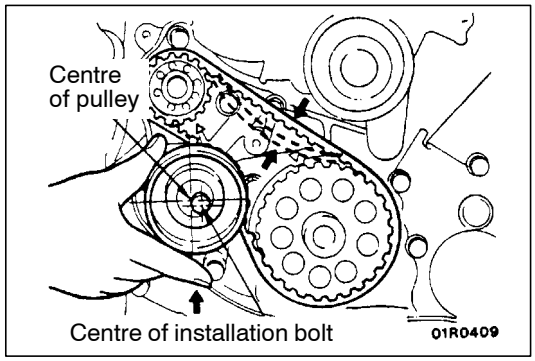


2. Adjust timing belt "B" by the following procedure,
   (1) Temporarily fix the timing belt "B" tensioner such that the centre of the tensioner pulley is to the left and above the centre of the installation bolt, and temporarily attach the tensioner pulley so that the flange is toward the front of the engine.



   (2) Holding the timing belt "B" tensioner up with your finger in the direction of the arrow, place pressure on the timing belt so that the tension side of the belt is taut. Now tighten the bolt to fix the tensioner.

   Caution
   When tightening the bolt, ensure that the tensioner pulley shaft does not rotate with the bolt. Allowing it to rotate with the bolt can cause excessive tension of the belt.



   (3) Check to ensure that when centre of span on tension side is depressed with index finger in direction of arrow, tension of belt is up to specification.

   Standard value: 5 - 7 mm

▶B◀ CRANKSHAFT SPROCKET INSTALLATION

1. Apply as little engine oil as possible to the seat and the thread of the crankshaft bolt.
2. Secure the crankshaft sprocket in the same way as during removal, and then tighten the bolt to the specified torque.

   Tightening torque: 108 - 127 Nm

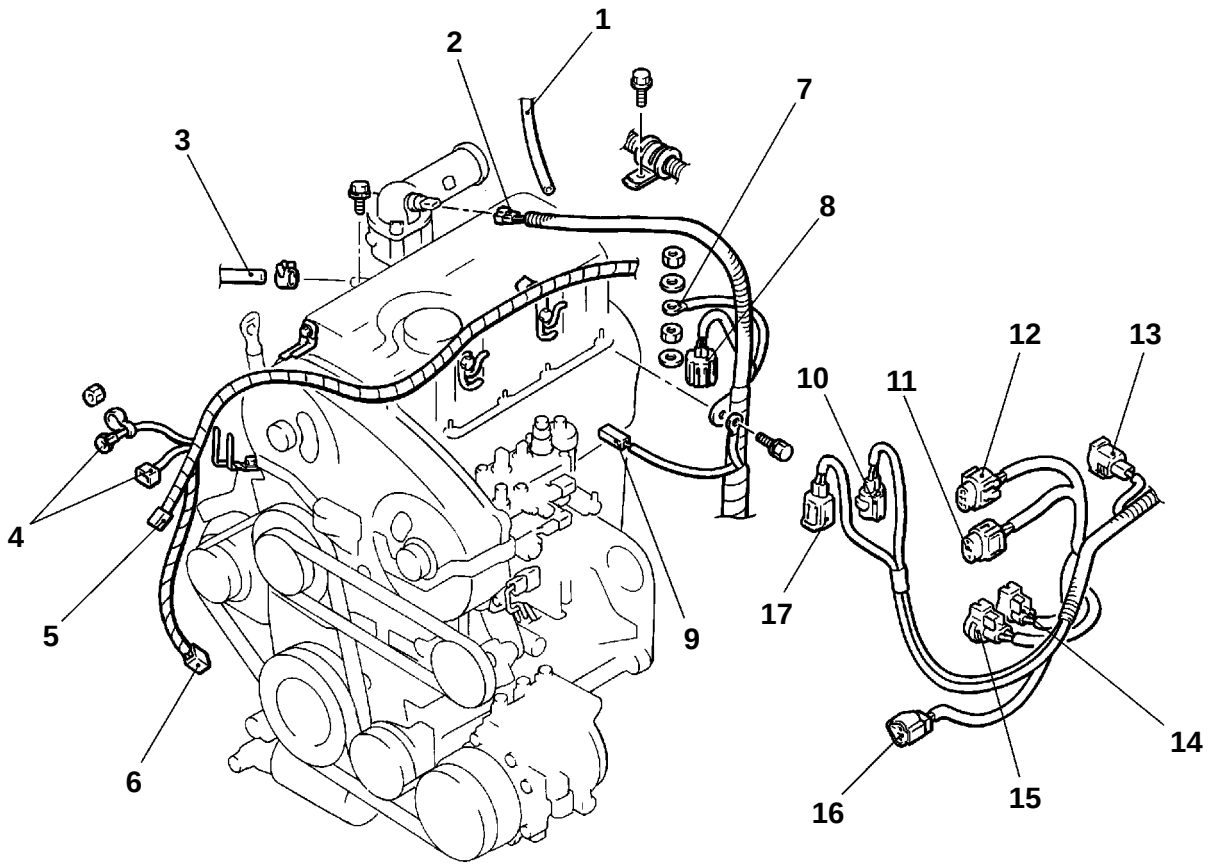
ENGINE ASSEMBLY

11200100565

REMOVAL AND INSTALLATION

Pre-removal Operation
- Hood Removal (Refer to GROUP 42.)
- Air Cleaner Assembly Removal
- Engine Coolant Draining
- Radiator Assembly Removal (Refer to GROUP 14.)
- Under Cover Removal
- Front Exhaust Pipe Removal (Refer to GROUP 15.)

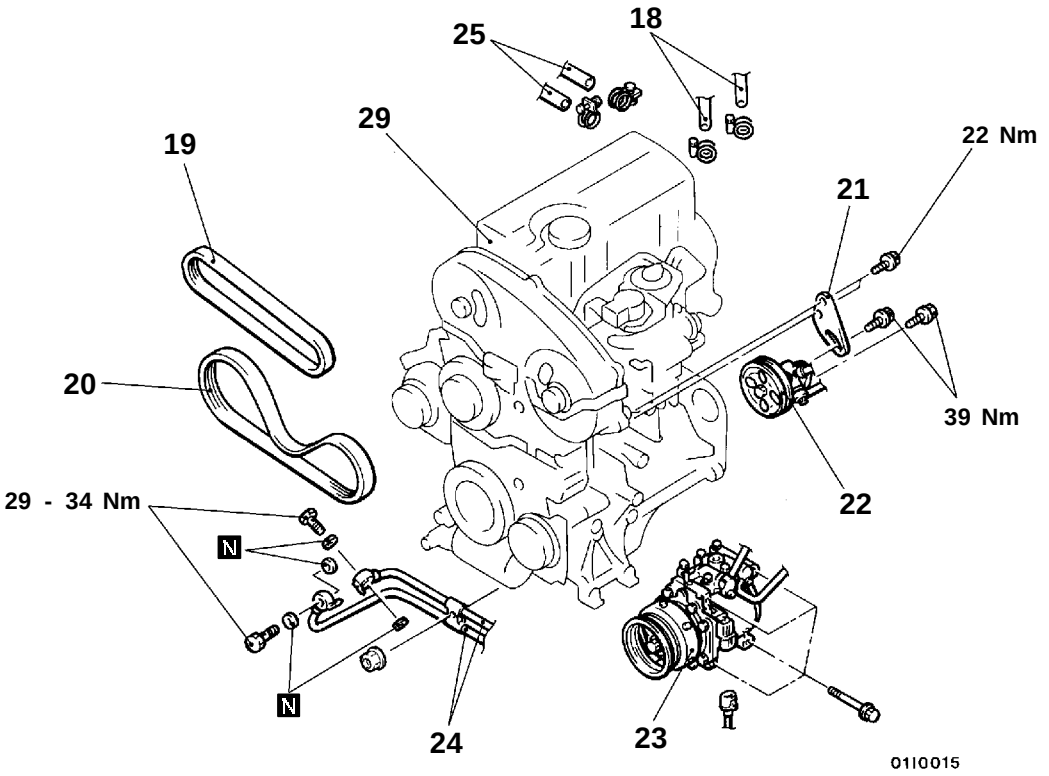
Post-installation Operation
- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Under Cover Installation
- Radiator Assembly Installation (Refer to GROUP 14.)
- Engine Coolant Supplying
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)
- Air Cleaner Assembly Installation
- Hood Installation (Refer to GROUP 42.)

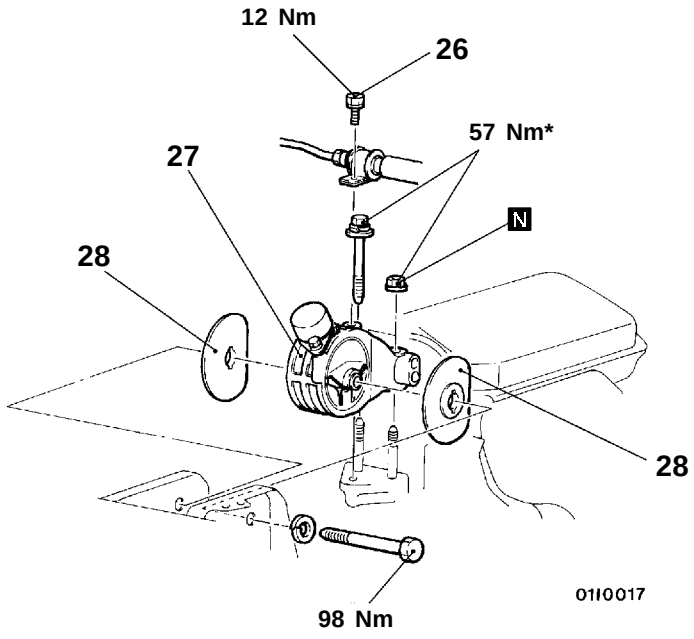


A0110072

Removal steps

1. Vacuum hose connection
2. Vacuum air temperature sensor connector
3. Brake booster vacuum hose connection
4. Alternator connector
5. Oil pressure switch connector
6. Engine oil level sensor connector
7. Glow plug connector
8. Engine coolant temperature sensor connector
9. Engine coolant temperature gauge unit connector
10. Pump revolution sensor connector
11. Timing control valve connector
12. Solenoid-type spill valve connector
13. Fuel cut solenoid valve connector
14. Injection rate correction resistor connector
15. Injection timing correction resistor connector
16. Crank angle sensor connector
17. Fuel temperature sensor connector





00006493

18. Heater hose connection
19. Drive belt (Power steering)
20. Drive belt (A/C)
21. Oil pump brace
◀A▶ 22. Power steering oil pump and bracket assembly
◀B▶ 23. A/C compressor
24. Engine oil cooler pipe connection
25. Fuel hose connection
26. Clamp bolt (Power steering hose and pipe)
◀C▶ • Transmission assembly
◀D▶ ▶C◀ 27. Engine mount bracket
▶B◀ 28. Engine mount stopper
◀E▶ ▶A◀ 29. Engine assembly

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

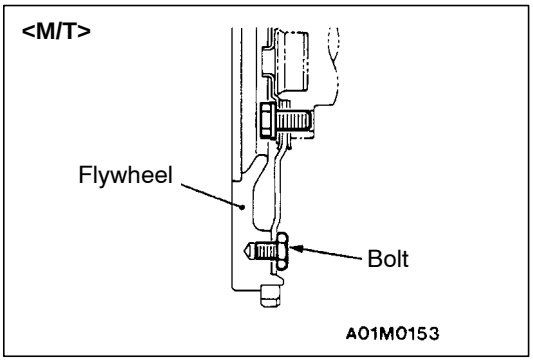
Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

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

◀B▶ A/C COMPRESSOR REMOVAL

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

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

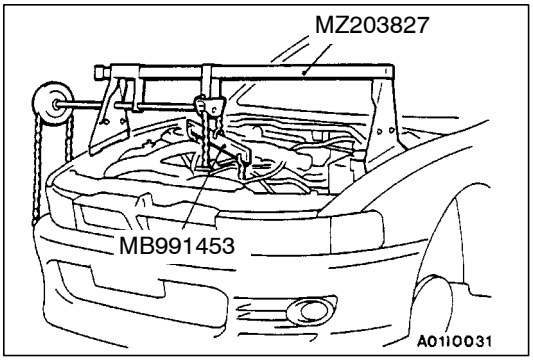


◀C▶ TRANSMISSION ASSEMBLY REMOVAL

<M/T>:
Refer to GROUP 22.

Caution
Do not remove the flywheel mounting bolt shown by the arrow. If this bolt Is removed, the flywheel will become out of balance and damaged.

<A/T>:
Refer to GROUP 23.



◀D▶ 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.

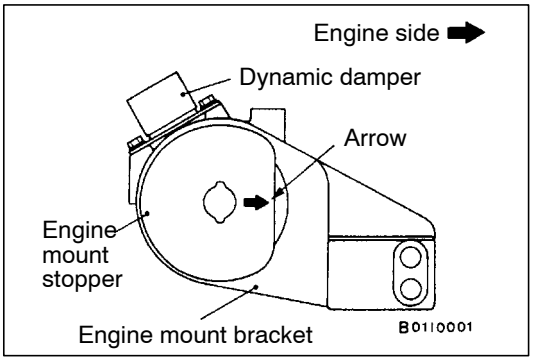
◀E▶ ENGINE ASSEMBLY REMOVAL

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 STOPPER INSTALLATION

Clamp the engine mount stopper so that the arrow points in the direction as shown in the diagram.

▶C◀ ENGINE MOUNT BRACKET INSTALLATION

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