ENGINE

Click on the applicable bookmark to selected the required model year

ENGINE <4G9>

CONTENTS

GENERAL INFORMATION

Items			4G93
Total displacement mℓ			1,834
Bore × Stroke mm			81.0 ×89.0
Compression ratio			12.0
Combustion chamber			Pentroof + ball-in-piston
Camshaft arrangement			DOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 15°
		Closing	ABDC 56°
	Exhaust	Opening	BBDC 55°
		Closing	ATDC 15°
Fuel system			Electronically controlled multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Alternator drive belt tension	Vibration frequency Hz	When checked	143 – 185	–
		When a used belt is installed	155 – 175	–
		When a new belt is installed	203 – 234	–
	Tension N	When checked	294 – 490	–
		When a used belt is installed	343 – 441	–
		When a new belt is installed	588 – 784	–
	Deflection (Reference value) mm	When checked	9.7 – 12.9	–
		When a used belt is installed	10.5 – 12.0	–
		When a new belt is installed	6.7 – 8.5	–

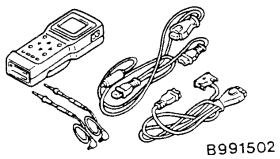
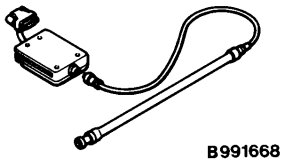
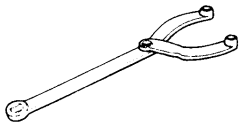
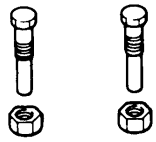
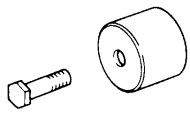
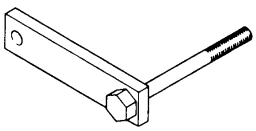
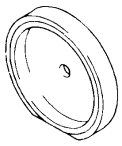
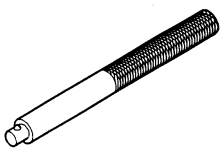
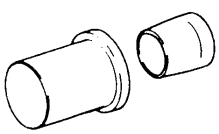
Items			Standard value	Limit
Power steering oil pump and A/C compressor drive belt tension	Vibration frequency Hz	When checked	114 – 139	–
		When a used belt is installed	121 – 133	–
		When a new belt is installed	145 – 166	–
	Tension N	When checked	392 – 588	–
		When a used belt is installed	441 – 539	–
		When a new belt is installed	637 – 833	–
	Deflection (Reference value) mm	When checked	10.0 – 12.0	–
		When a used belt is installed	10.0 – 11.0	–
		When a new belt is installed	7.0 – 9.0	–
Basic ignition timing			5° BTDC ± 3°	–
Ignition timing			Approx. 16° BTDC	–
Idle speed r/min			600 ± 100*	–
CO contents %			0.5 or less	–
HC contents ppm			100 or less	–
Compression pressure kPa – r/min			1,720 – 300	1,462 – 300
Compression pressure difference of all cylinder kPa			–	Max. 100
Intake manifold vacuum kPa			–	Min. 34
Cylinder head bolt shank length mm			–	96.4
Auto-tensioner push rod movement mm			Within 1	–
Timing belt tension torque Nm (Reference value)			2.5 – 4.0	–
Auto-tensioner rod protrusion amount mm			3.8 – 4.5	–

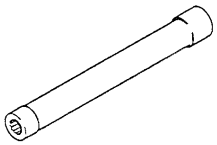
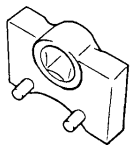
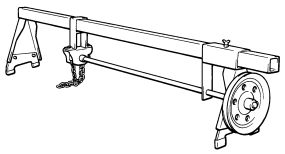
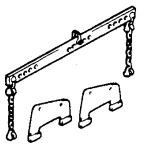
*: Varies depending on the transmission oil temperature. For details, refer to P. 11A-11.

SEALANTS

Items	Specified sealants	Remarks
Beam camshaft cap and cylinder head	3M ATD Part No.8660 or equivalent	Semi-drying sealant
Cam position sensor support Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	
Flywheel bolt	3M Stud Locking 4170 or equivalent	–

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	● Measuring the drive belt tension ● Checking the ignition timing ● Checking the idle speed ● Erasing diagnosis code
	MB991668	Belt tension meter set	Measuring the drive belt tension (Used together with the MUT-II)
	MB990767	End yoke holder	● Holding the camshaft sprocket ● Holding the crankshaft sprocket
	MD998719	Crankshaft pulley holder pin	● Holding the camshaft sprocket ● Holding the crankshaft sprocket
	MD998713	Camshaft oil seal installer	Press-fitting the camshaft oil seal
	MD998781	Flywheel stopper	Securing the flywheel
	MD998776	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
	MB990938	Handle	
	MD998717	Crankshaft front oil seal installer	Press-fitting the crankshaft front oil seal

Tool	Number	Name	Use
	MB991653	Cylinder head bolt wrench	Cylinder head bolt removal and installation
	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

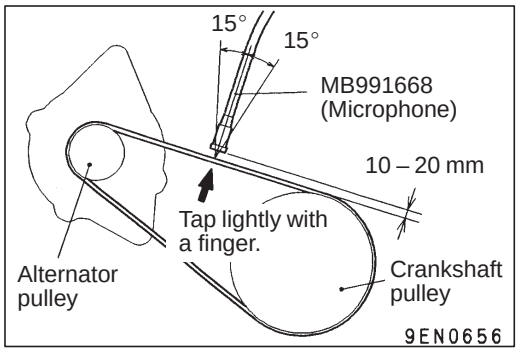
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Check the drive belt tension by the following procedure.

Standard value:

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

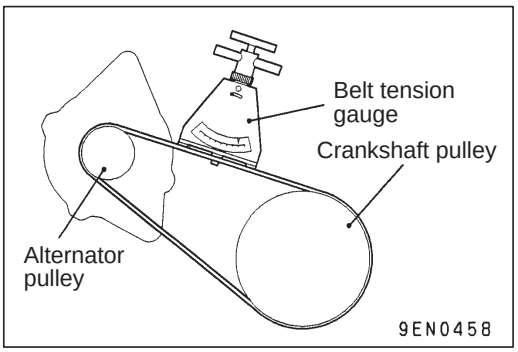


<When using the MUT-II>

1. Connect the special tool (belt tension meter kit) to the MUT-II.
2. Connect the MUT-II to the diagnosis connector.
3. Turn the ignition switch to ON and select “Belt Tension Measurement” from the menu screen.
4. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ± 15°).
5. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

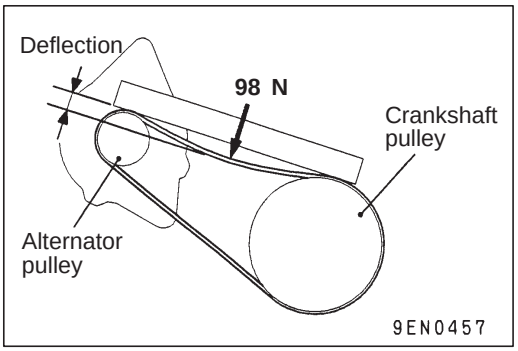
Caution

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



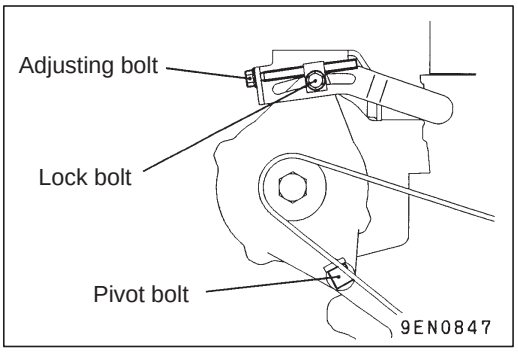
<When using a tension gauge>

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



<Belt deflection check>

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



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

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

   Standard value:

Items	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	155 – 175	203 – 234
Tension N	343 – 441	588 – 784
Deflection (Reference value) mm	10.5 – 12.0	6.7 – 8.5

   NOTE
   Refer to P.11A-7 concerning the measurement procedure of the alternator drive belt tension.

4. Tighten the nut of the alternator pivot bolt.

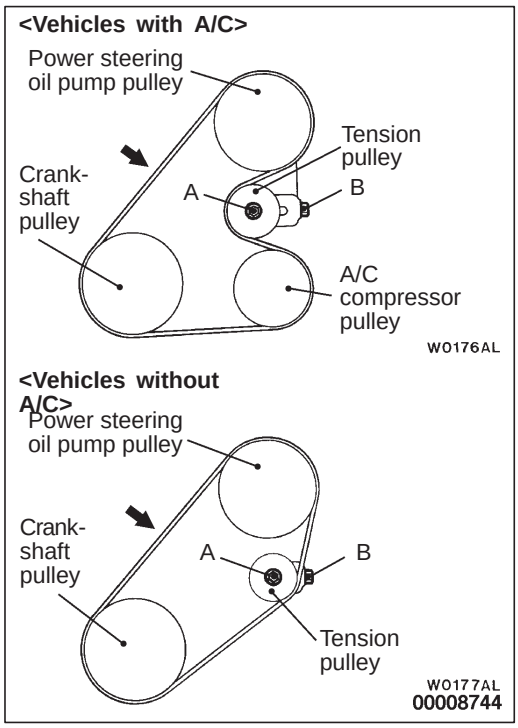
   Tightening torque: 44 Nm

5. Tighten the lock bolt.

   Tightening torque: 22 Nm

6. Tighten the adjusting bolt.

   Tightening torque: 5 Nm



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

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

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

   NOTE
   Refer to P.11A-7 for details on the method of measuring the vibration frequency using the MUT-II.

   <When using a tension gauge>
   Use a belt tension gauge to check that the belt tension is within the standard value.

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

   Standard value:

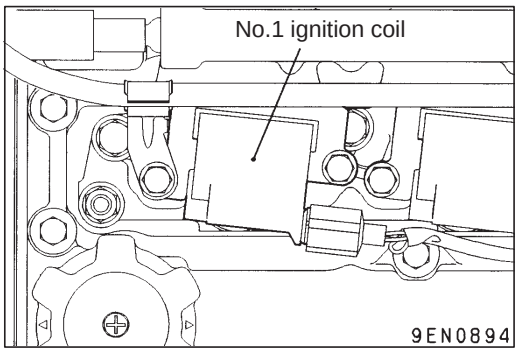
Items	When checked	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	114 – 139	121 – 133	145 – 166
Tension N	392 – 588	441 – 539	637 – 833
Deflection (Reference value) mm	10.0 – 12.0	10.0 – 11.0	7.0 – 9.0

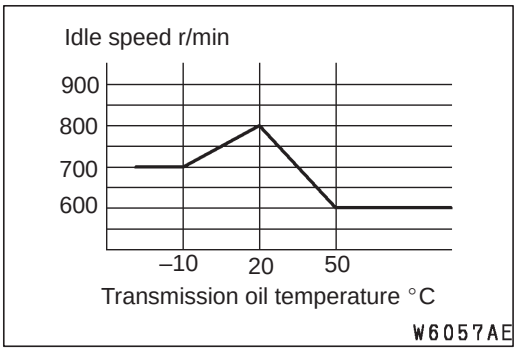
2. If outside the standard value, adjust by the following procedure.
   (1) Loosen the tensioner pulley fixing bolt A.
   (2) Adjust the amount of belt deflection using adjusting bolt B.
   (3) Tighten the fixing bolt A

   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

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn off the ignition switch and then connect the MUT-II to the diagnosis connector.
3. Set the timing light to the power supply line (terminal No.1) of the ignition coil No.1.

   NOTE
   The power supply line is looped and also longer than the other ones.
4. Start the engine and let it run at idle.
5. Use the MUT-II to measure engine idle speed and check that it is within the standard value.

   Standard value: 600 ± 100 r/min*

   NOTE
   (1) *: The idle speed in vehicles with manual transmission varies in accordance with the transmission oil temperature.
   (2) After 4 minutes or more have passed in the idle running condition, the idle speed will become 750 r/min.
6. Select No.17 of the MUT-II Actuator test.

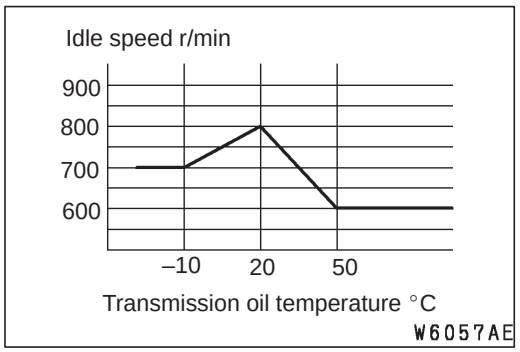
   NOTE
   At this time, the engine speed will become approximately 750 r/min.
7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC ± 3°
8. If the basic ignition timing is outside the standard value, inspect the GDI 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. 16°BTDC

    NOTE
    (1) The ignition timing will become approximately 6°BTDC after more than 4 minutes have passed since the basic ignition timing set mode was released.
    (2) The ignition timing may fluctuate within ±7°BTDC. This is nomral.
    (3) In higher altitude, the ignition timing is more advanced than the standard value by approximately 5 degree.
11. Remove the timing light.
12. Turn off the ignition switch and then remove the MUT-II.



IDLE SPEED CHECK

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

   NOTE
   Refer to P.11A-10 concerning the check procedure of the basic ignition timing.

   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.

   Standard value: 600 ± 100 r/min*

   NOTE
   (1) *: The idle speed in vehicles with manual transmission varies in accordance with the transmission oil temperature.
   (2) After 4 minutes or more have passed in the idle running condition, the idle speed will become 750 r/min.
   (3) The idle speed is controlled automatically adjusted by the idle speed control system.

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

IDLE MIXTURE CHECK

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

   NOTE
   Refer to P.11A-10 concerning the check procedure of the basic ignition timing.

   Standard value: 5° BTDC ± 3°

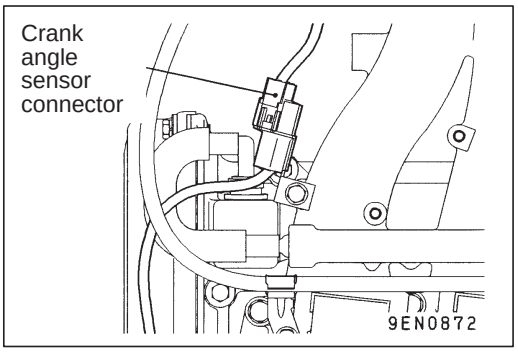
4. Run the engine at 2,500 r/min for 2 minutes.
5. Set the CO, HC tester.
6. Check the CO contents and the HC contents at idle.

   NOTE
   This measurement should be performed in less than approximately 4 minutes since the engine speed become the idle speed.

   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
   - Fuel pressure
   - Injector
   - Ignition coil, spark plug
   - EGR control system
   - 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.



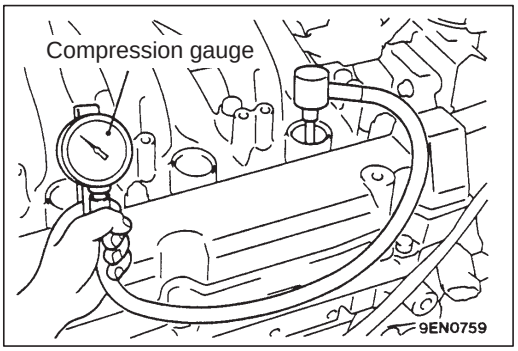
COMPRESSION PRESSURE CHECK

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

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

4. 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.



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

   Standard value (at engine speed of 300 r/min):
   1,720 kPa

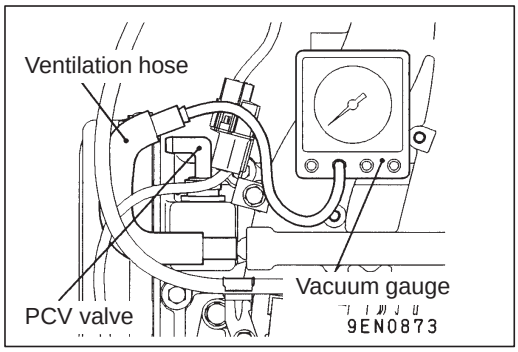
   Limit (at engine speed of 300 r/min):
   Min. 1,462 kPa

7. 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

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 spark 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 crank angle sensor connector.
10. Install the spark plugs and ignition coils.
11. Use the MUT-II to erase the diagnosis codes.

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



MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose.
3. Check the intake manifold vacuum while the engine is idling.

   Limit: Min. 34 kPa

LASH ADJUSTER CHECK

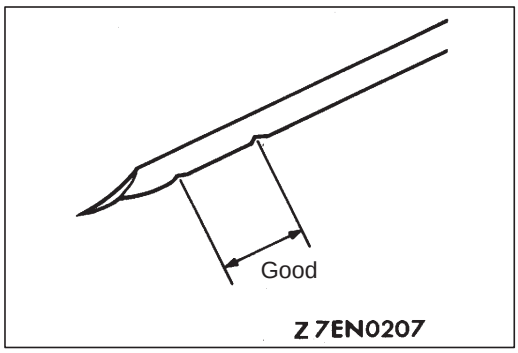
If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

NOTE
(1) The abnormal noise which is caused by a problem with the lash adjusters is generated after the engine is started, and will vary according to the engine speed. However, this noise is not related to the actual engine load.
Because of this, if the noise does not occur immediately after the engine is started, if it does not change in accordance with the engine speed, or if it changes in accordance with the engine load, the source of the noise is not the lash adjusters.
(2) If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.
The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)
3. While the engine is idling, check that the noise level does not change when the engine load is varied (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, clean the lash adjusters (Refer to the Engine Workshop Manual).
If the noise level does not change, go to step 5.
5. Bleed the air from the lash adjusters. (Refer to P.11A-15.)
6. If the noise does not disappear even after the air has been bled from the lash adjusters, clean the lash adjusters. (Refer to the Engine Workshop Manual.)

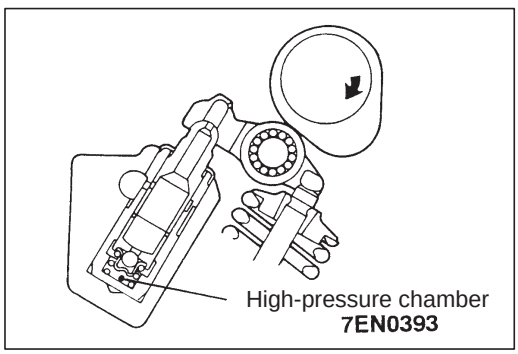
<LASH ADJUSTER AIR BLEEDING>

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



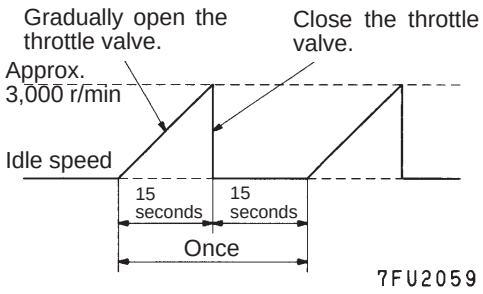
1. Check the engine oil and replenish or replace the oil if necessary.

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



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

Drive pattern for air bleeding



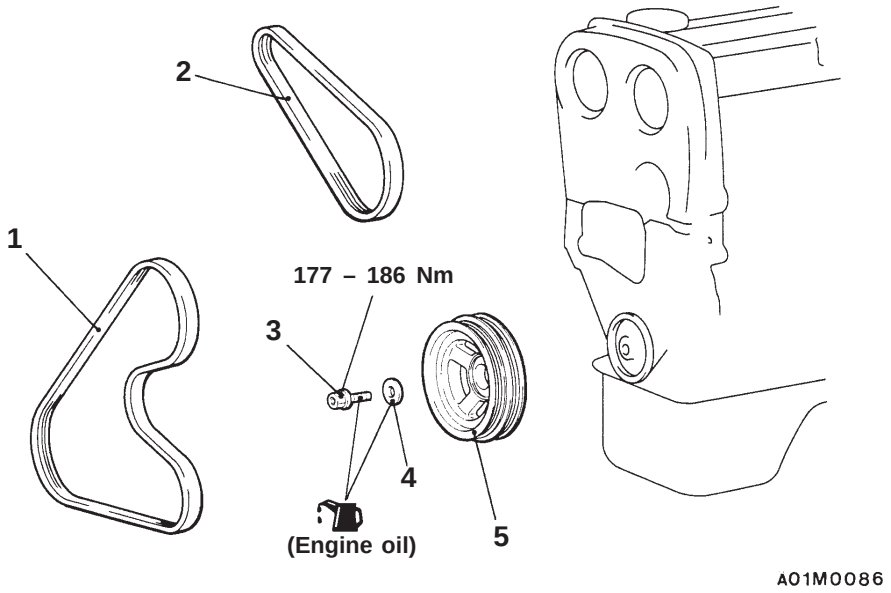
2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level 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

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover Panel RH Removal

Post-installation Operation
- Drive Belt Tension Adjustment (Refer to P.11A-7.)
- Under Cover Panel RH Installation

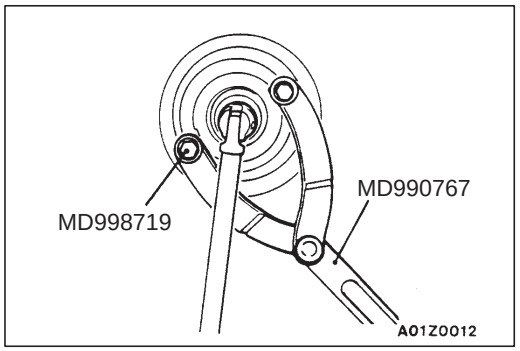


Removal steps

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

◀A▶ ▶A◀ 3. Crankshaft bolt

4. Crankshaft pulley washer
5. Crankshaft pulley



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT BOLT REMOVAL

INSTALLATION SERVICE POINT

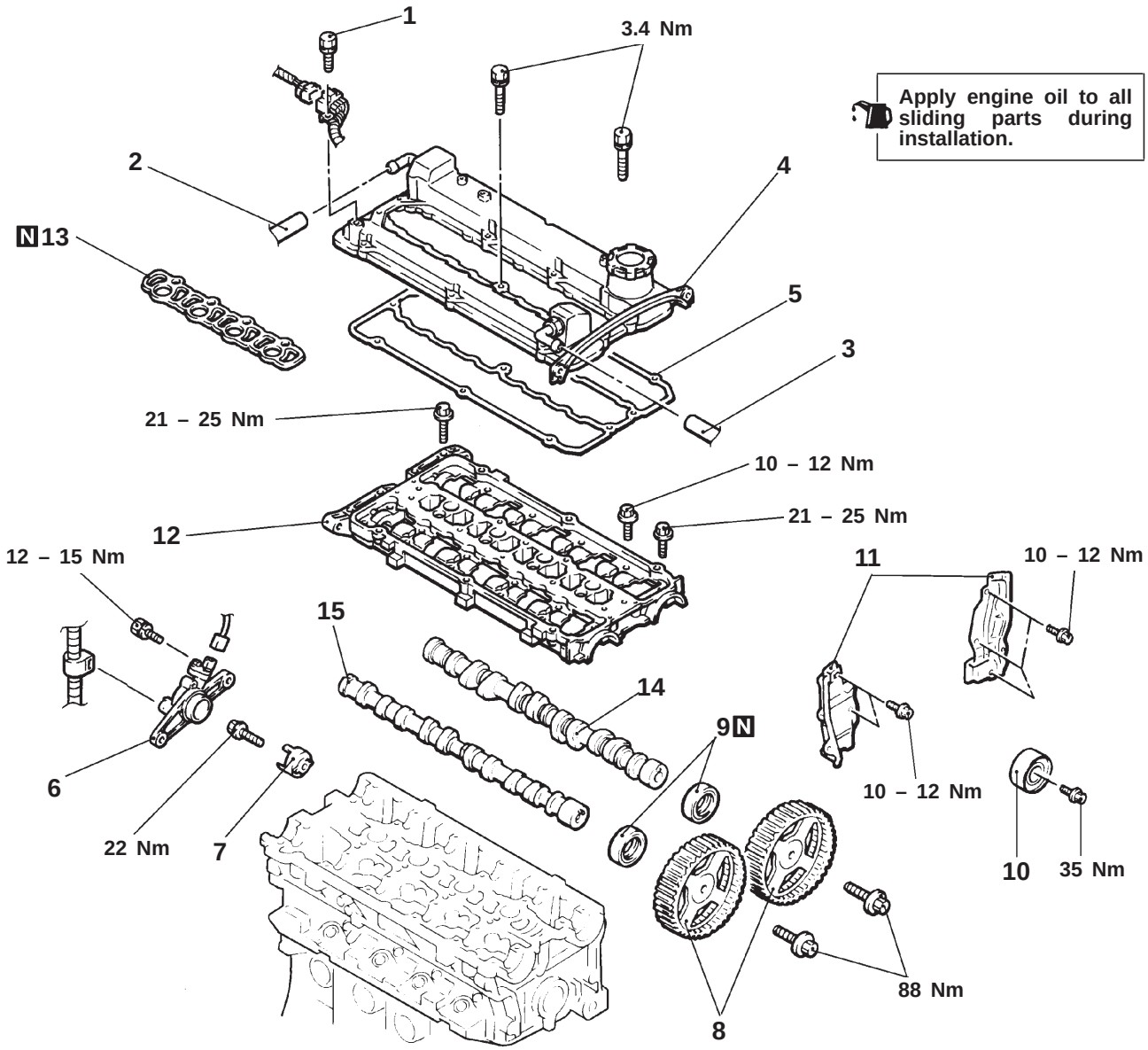
▶A◀ CRANKSHAFT BOLT INSTALLATION

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

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Air Intake Hose Removal and Installation
- Timing Belt Removal and Installation (Refer to P.11A-29.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Pump Camshaft Case Removal and Installation (Refer to GROUP 13A – High Pressure Fuel Pump.)

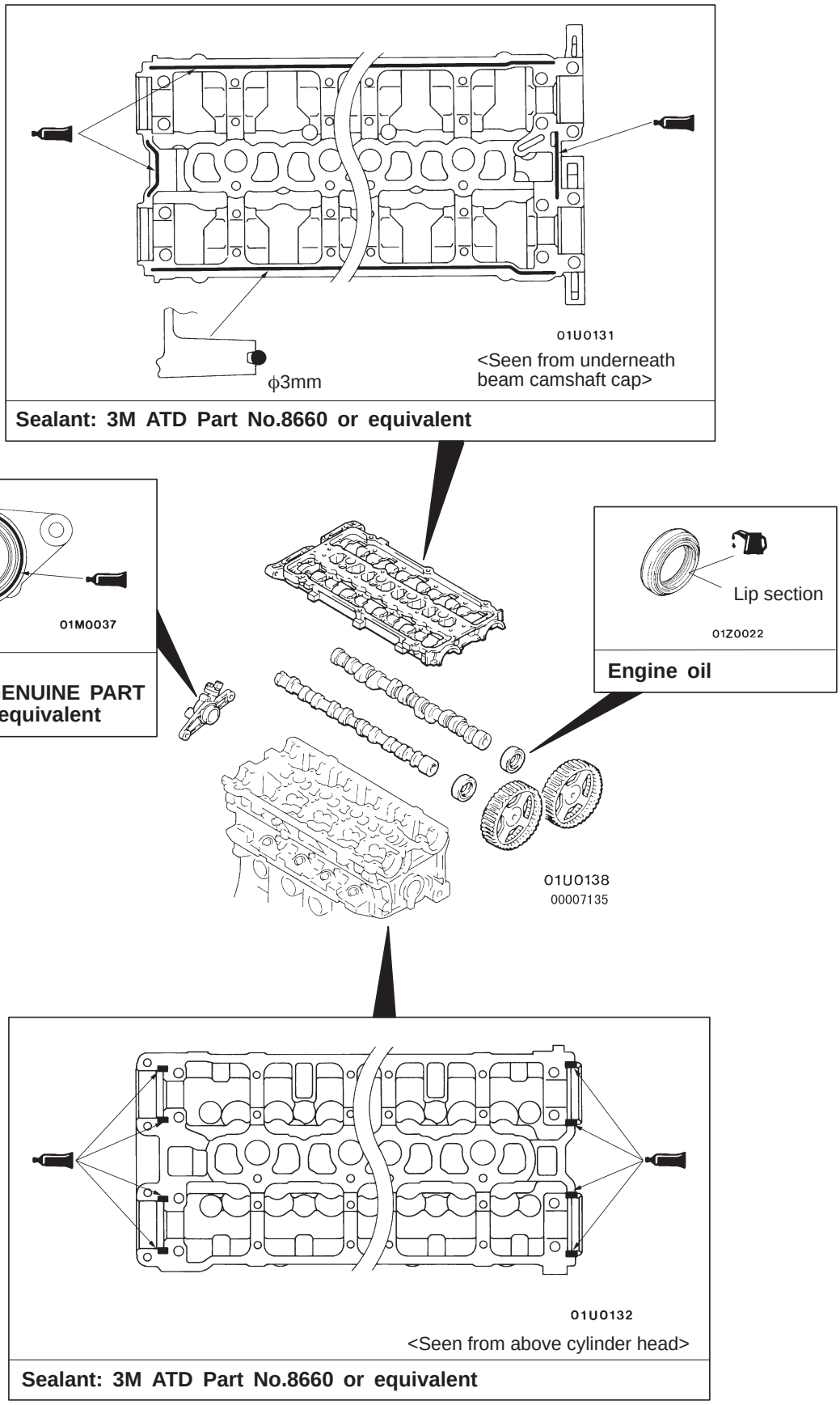


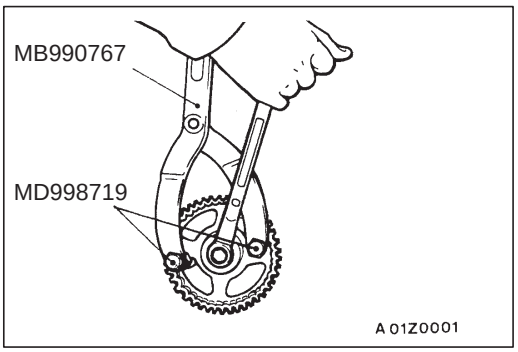
Removal steps

1. Connector bracket mounting bolt (Injector Harness)
2. Breather hose connection
3. PCV hose connection
4. Rocker cover
5. Rocker cover gasket
6. Cam position sensor support
7. Cam position sensing cylinder

◀A▶ ▶D◀ 8. Camshaft sprocket
▶C◀ 9. Camshaft oil seal
10. Idler pulley
11. Timing belt rear cover
▶B◀ 12. Beam camshaft cap
13. Beam camshaft cap gasket
▶A◀ 14. Camshaft (exhaust side)
▶A◀ 15. Camshaft (intake side)

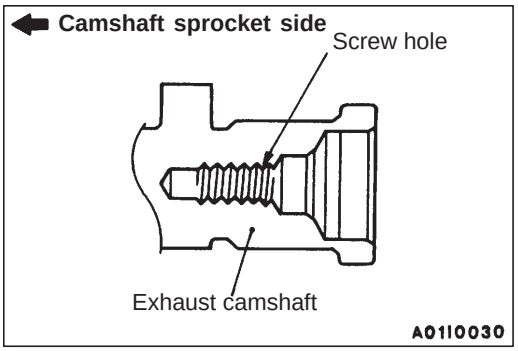
Lubrication points





REMOVAL SERVICE POINT

◀A▶ CAMSHAFT SPROCKET REMOVAL

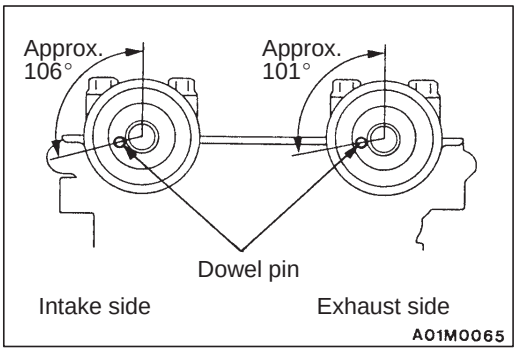


INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

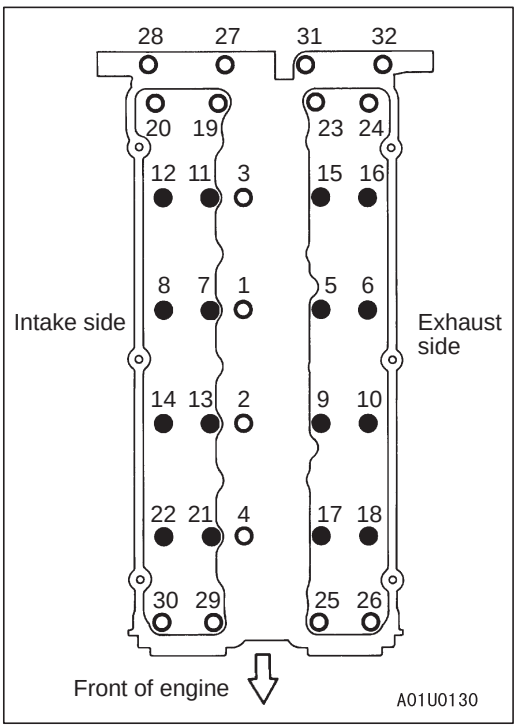
1. Apply engine oil to journals and cams of the camshafts.
2. Install the camshafts on the cylinder head.

Caution
Be careful not to confuse the intake camshaft with the exhaust one. There is a screw hole for the cam position sensing cylinder mounting bolt on the exhaust-side camshaft.



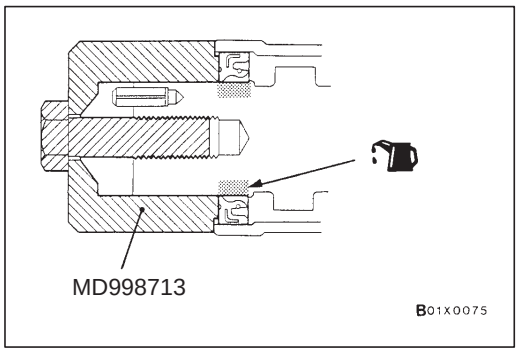
▶B◀ BEAM CAMSHAFT CAP INSTALLATION

1. Place the camshaft dowel pin as shown in the illustration.



2. Tighten the beam camshaft cap mounting bolts to the specified torque in the order shown in the illustration.

Tightening torque:
- **● : 10 – 12 Nm**
- **○ : 21 – 25 Nm**



▶C◀ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the entire circumference of the oil seal lip.
2. Press-fit the oil seal as shown in the illustration.

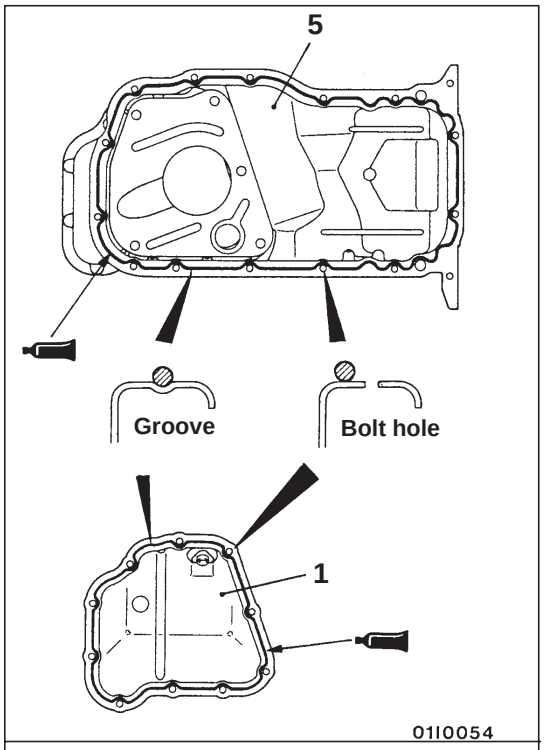
▶D◀ CAMSHAFT SPROCKET INSTALLATION

Use the special tool to secure the camshaft sprocket in the same way as during removal, and then tighten the bolt to the specified torque.

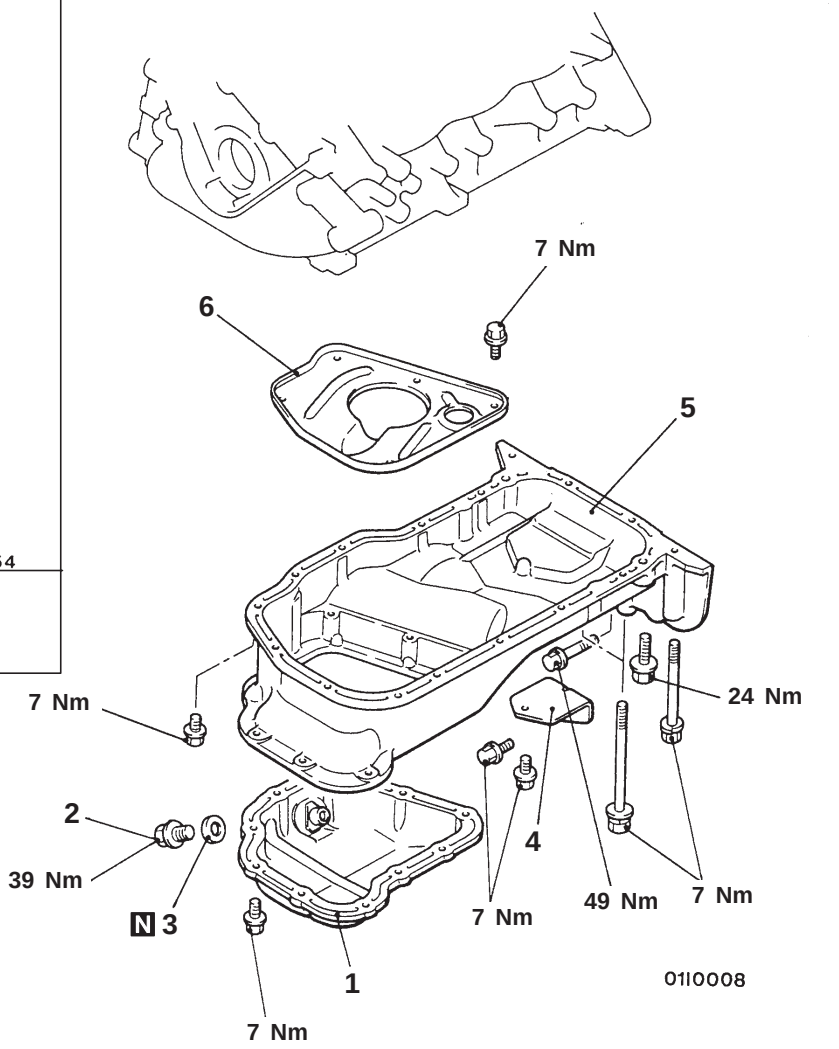
OIL PAN

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 Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)

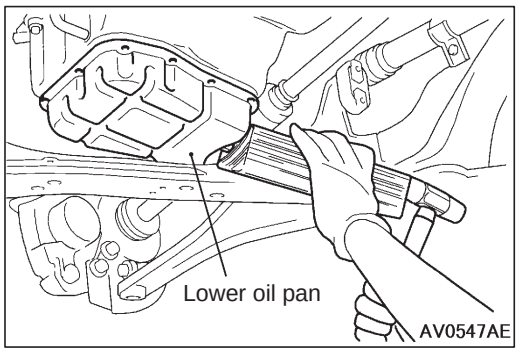


Sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent



Removal steps

◀A▶ 1. Lower oil pan
2. Drain plug
▶A◀ 3. Drain plug gasket
4. Cover
5. Upper oil pan
◀B▶ 6. Baffle plate

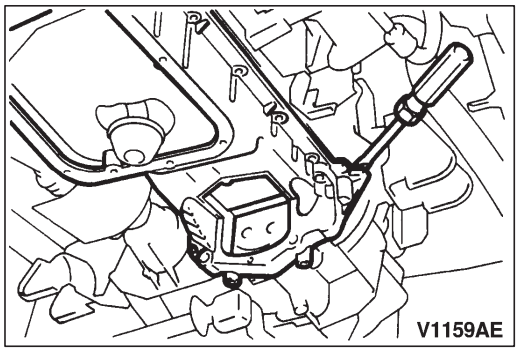


REMOVAL SERVICE POINTS

◀A▶ LOWER OIL PAN REMOVAL

Place a piece of wood against the lower oil pan, and tap the piece of wood with a hammer to remove the lower oil pan.

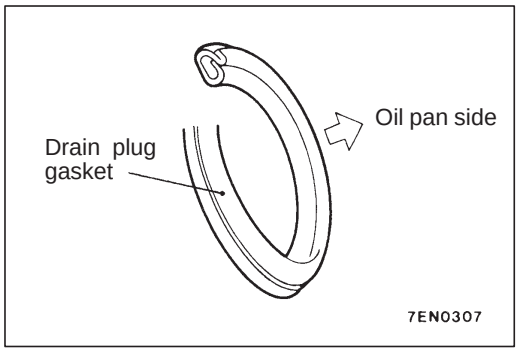
Caution
Because the upper oil pan used is made from aluminium, the oil pan remover (MB998727) should not be used.



◀B▶ UPPER OIL PAN REMOVAL

Insert a flat-tipped screwdriver into the notch of the upper oil pan as shown in the illustration, and turn it to remove the oil pan.

Caution
Because the upper oil pan used is made from aluminium, the oil pan remover (MB998727) should not be used.



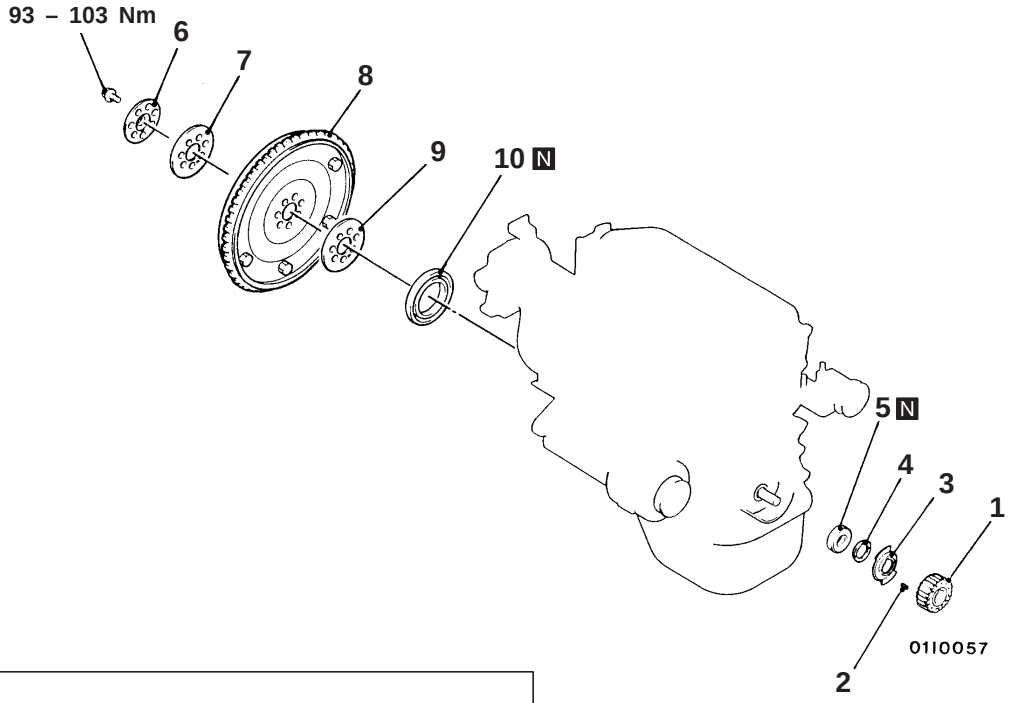
INSTALLATION SERVICE POINTS

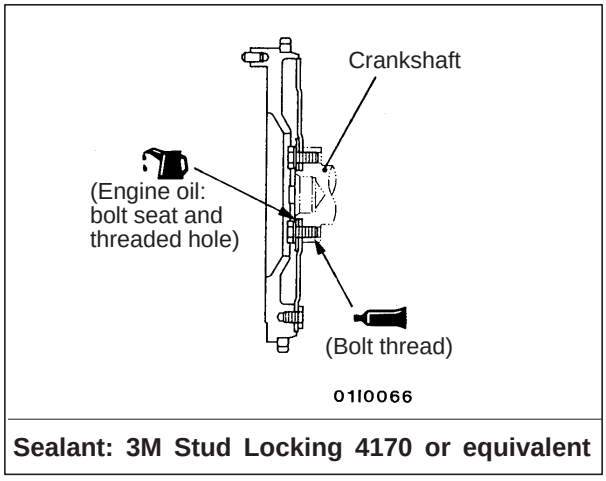
▶A◀ DRAIN PLUG GASKET INSTALLATION

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

CRANKSHAFT OIL SEAL

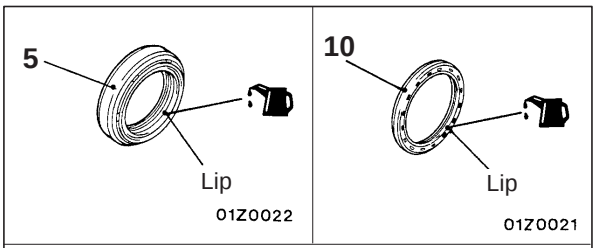
REMOVAL AND INSTALLATION





Sealant: 3M Stud Locking 4170 or equivalent

00009319



Engine oil

Crankshaft front oil seal removal steps

- Timing belt (refer to P.11A-29.)
- Crank angle sensor (Refer to GROUP 16.)

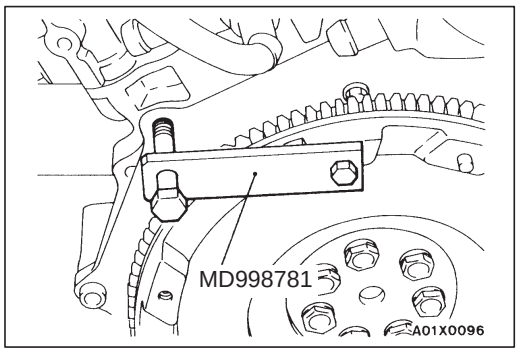
1. Crankshaft sprocket
2. Key
3. Crankshaft sensing blade
4. Crankshaft spacer

▶C◀ 5. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

- Transmission assembly (Refer to GROUP 22.)
- Clutch cover and disc

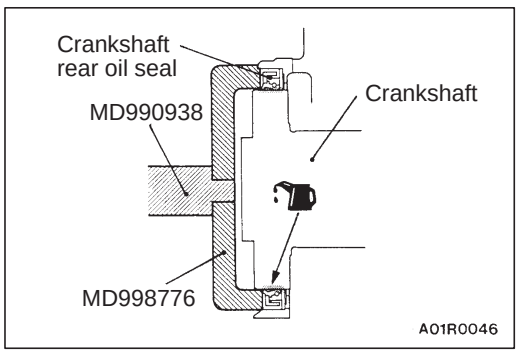
◀A▶ ▶B◀ 6. Plate
◀A▶ ▶B◀ 7. Adapter plate
◀A▶ ▶B◀ 8. Flywheel
◀A▶ ▶B◀ 9. Adapter plate
▶A◀ 10. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ PLATE/ADAPTOR PLATE/FLYWHEEL REMOVAL

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



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Apply a small 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.

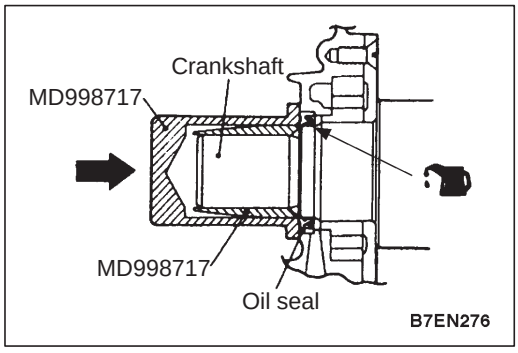
▶B◀ ADAPTOR PLATE/FLYWHEEL ASSEMBLY/PLATE INSTALLATION

1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel.
2. Apply oil to the bearing surface of the flywheel 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 secure the flywheel, and then tighten the bolts to the specified torque.

   Specified torque: 93 – 103 Nm



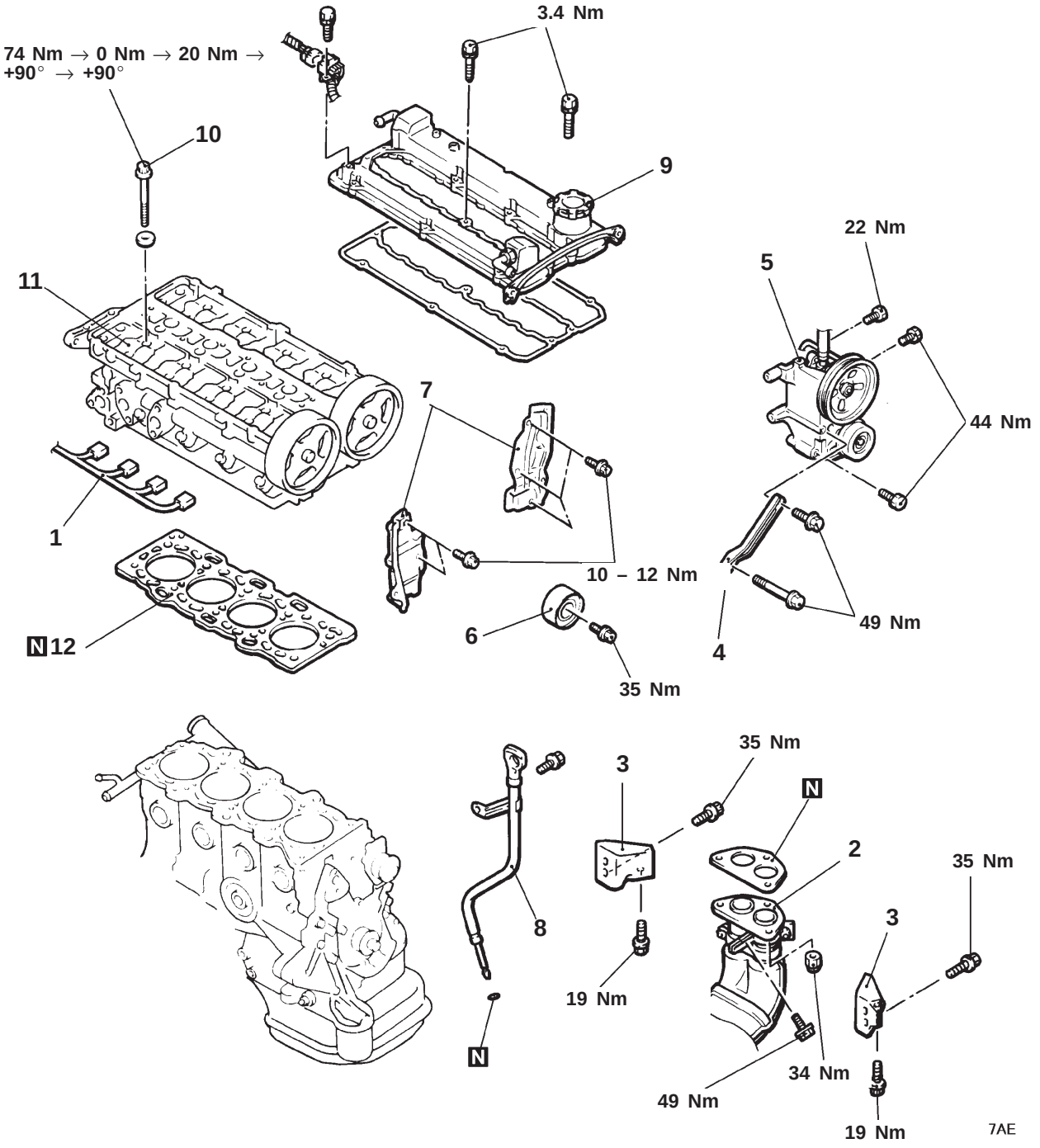
▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of Fuel Discharge <before removal only> (Refer to GROUP 13A – On-vehicle Service.)
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Timing Belt Removal and Installation (Refer to P.11A-27.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- High-pressure Fuel Pump and High-pressure Pressure Regulator Removal and Installation (Refer to GROUP 13A.)
- EGR Valve Assembly Removal and Installation (Refer to GROUP 17.)
- Thermostat Case Assembly and Radiator upper hose Removal and Installation (Refer to GROUP 14 – Water Hose and Water Pipe.)



Removal steps

1. Injector harness connector
2. Front exhaust pipe connection
3. Exhaust manifold bracket
4. Power steering oil pump bracket stay

◀A▶ 5. Power steering oil pump and bracket assembly

6. Idler pulley
7. Timing belt rear cover
8. Engine oil level gauge assembly
9. Rocker cover

◀B▶ ▶B◀ 10. Cylinder head bolt

11. Cylinder head assembly

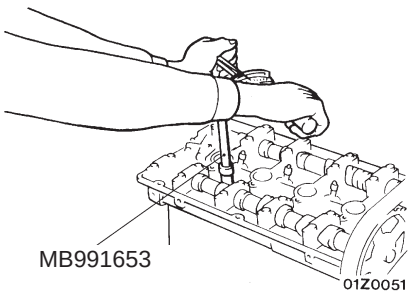
▶A◀ 12. Cylinder head gasket

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

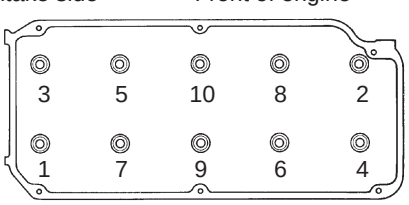
Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

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



◀B▶ CYLINDER HEAD BOLT REMOVAL

Use the special tool to loosen the bolts in two or three stages in the order of the numbers shown in the illustration, and then remove the bolts.



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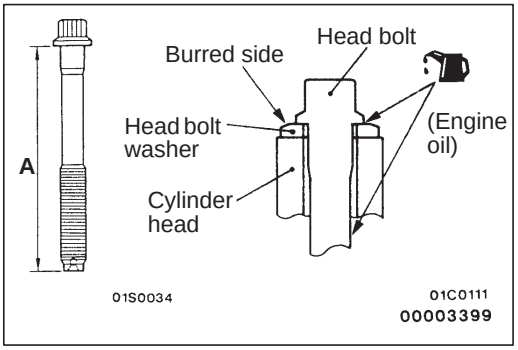
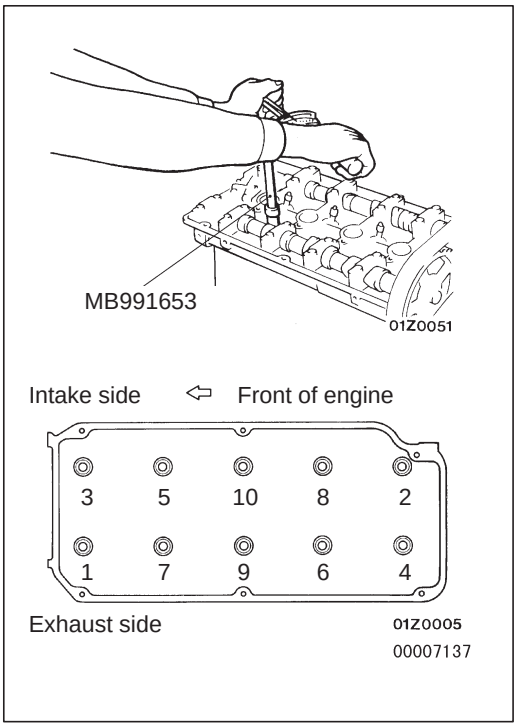
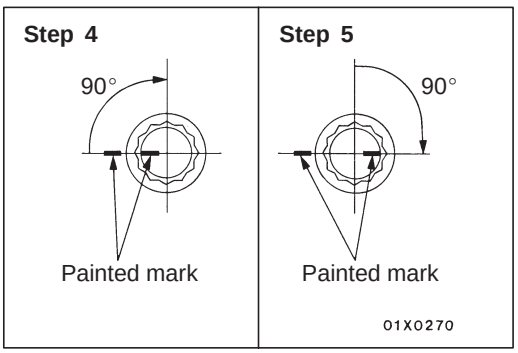
INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

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







▶B◀ CYLINDER HEAD BOLT INSTALLATION

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

   Limit (A): 96.4 mm

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

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

Caution

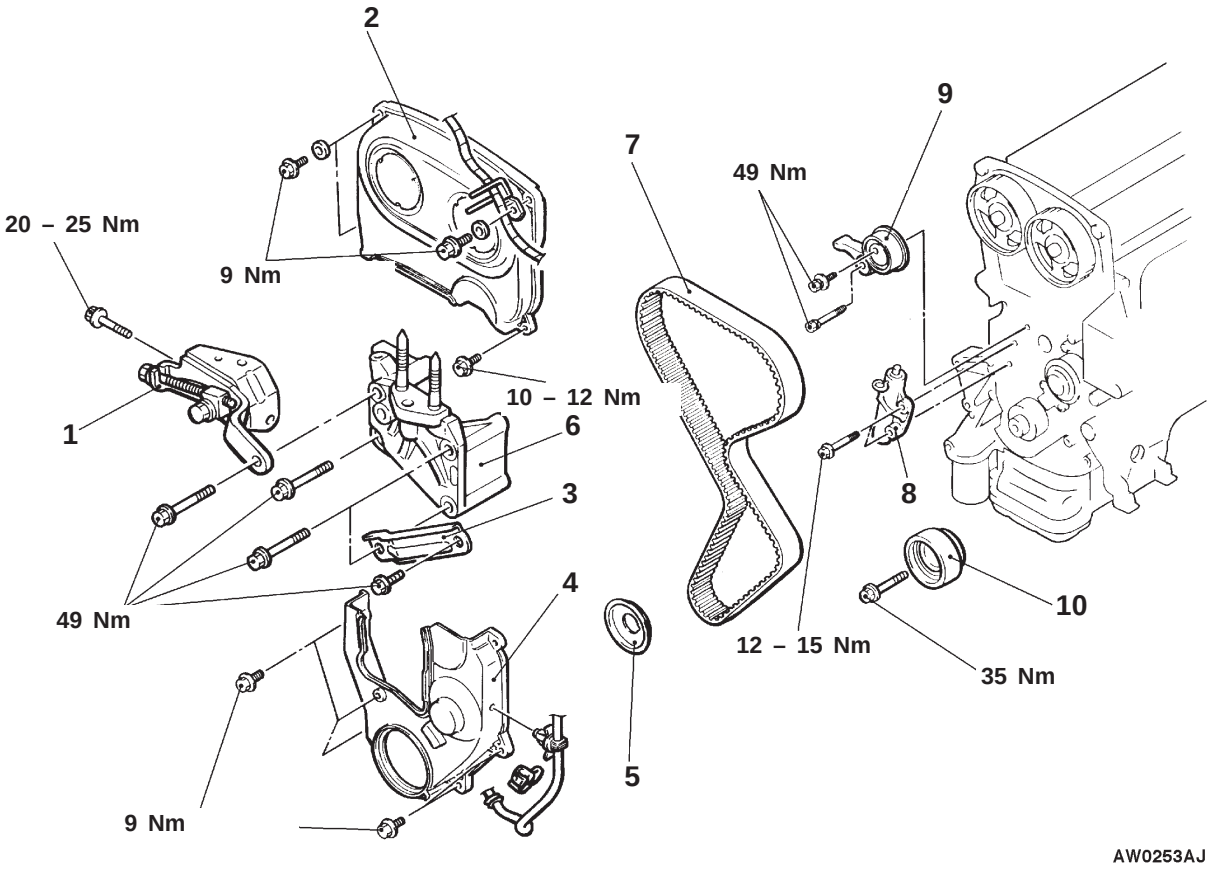
(1) Always make a tightening angle just 90°. If it is less than 90°, the head bolt will be loosened.

(2) If it is more than 90°, remove the head bolt and repeat the procedure from step 1.

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation
- Under Cover Removal and Installation
- Crankshaft Pulley Removal and Installation (Refer to P.11A-17.)

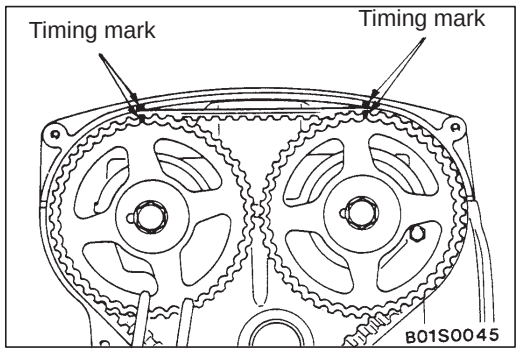


Removal steps

1. Alternator brace
2. Timing belt front upper cover
3. Power steering pump bracket stay
4. Timing belt front lower cover
5. Flange
- Engine mount bracket (Refer to GROUP 32.)

◀A▶ ▶C◀ ▶B◀ ▶A◀

6. Engine support bracket
- Timing belt tension adjustment
7. Timing belt
8. Auto tensioner
9. Tensioner pulley and arm assembly
10. Idler pulley



REMOVAL SERVICE POINT

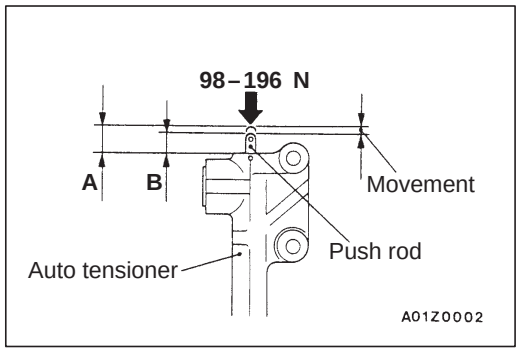
◀A▶ TIMING BELT REMOVAL

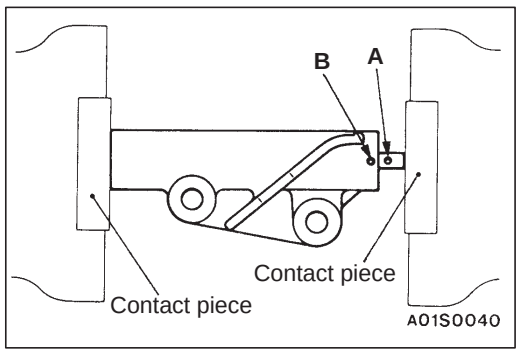
1. Turn the crankshaft clockwise to align each timing mark.

   Caution
   The crankshaft must always be turned clockwise.

2. Loosen the tensioner pulley center bolt and 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

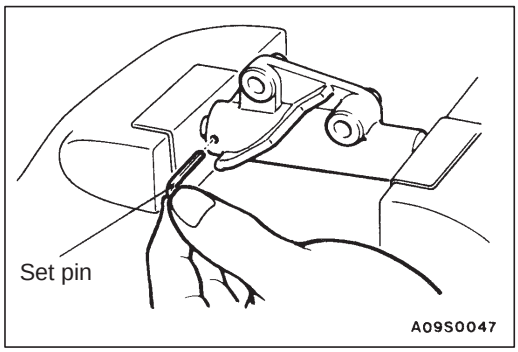
▶A◀ AUTO TENSIONER INSTALLATION

1. Apply 98–196 N force to the push rod of 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, change 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.

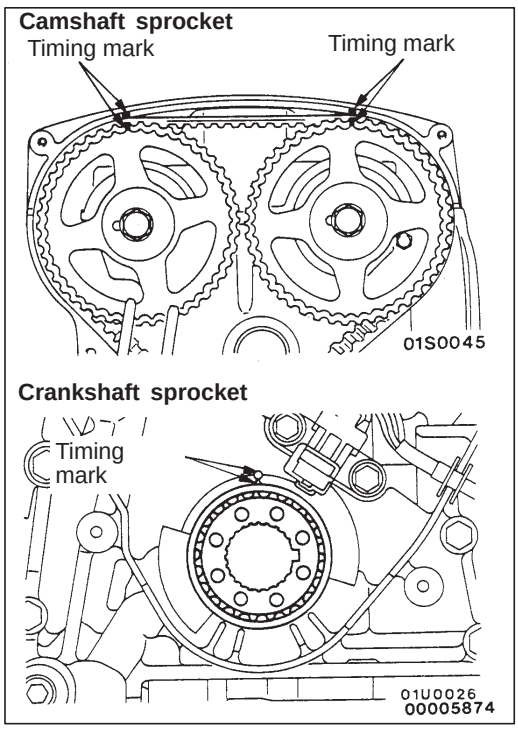
   Caution
   If the compression speed is too fast, the push rod may become damaged, so be sure to carry out this operation slowly.



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

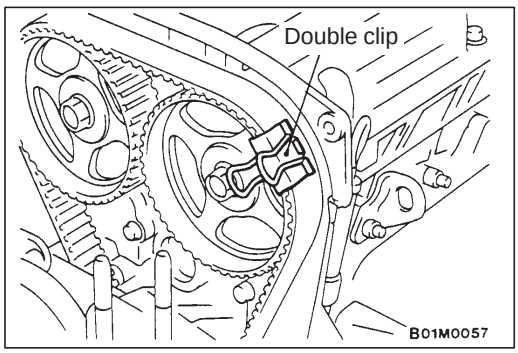
   NOTE
   When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.

5. Install the auto tensioner to the engine.

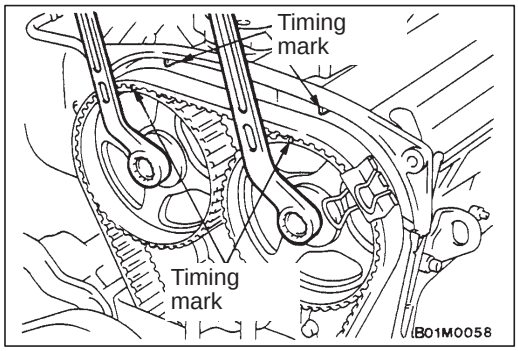


▶B◀ TIMING BELT INSTALLATION

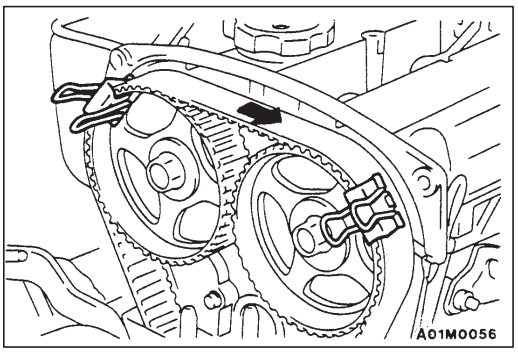
1. Align the timing marks of each camshaft sprocket and the crankshaft sprocket.
2. Loosen the tensioner pulley center bolt.
3. Move the crankshaft sprocket half a tooth width in the anti-clockwise direction.



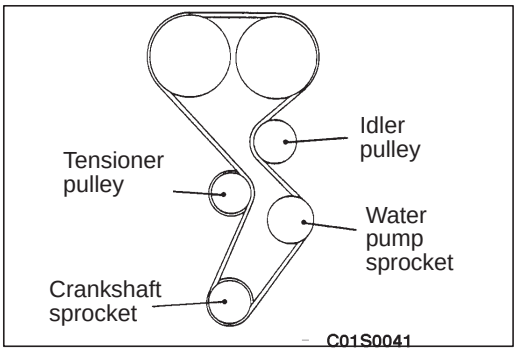
4. Place the timing belt on the exhaust-side camshaft sprocket, and hold it in the position shown in the illustration with a double clip.



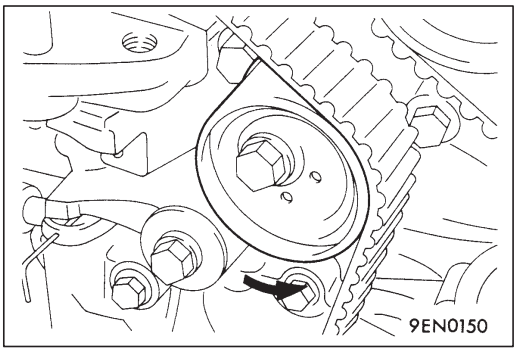
5. Place the timing belt on the intake-side sprocket while using two wrenches to align the timing marks.



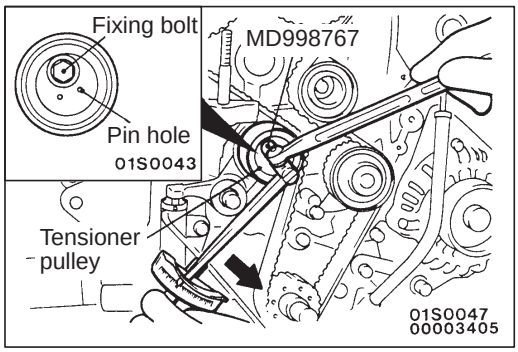
6. Hold the belt in the position shown in the illustration with another double clip.



7. Place the belt onto the idler pulley, water pump sprocket, crankshaft sprocket and tensioner pulley in that order.
8. Remove the two double clips.



9. Lift the tensioner pulley in the direction of the arrow and tighten the tensioner pulley bolt.
10. Check to be sure that all timing marks are aligned.
11. Adjust the timing belt tension.

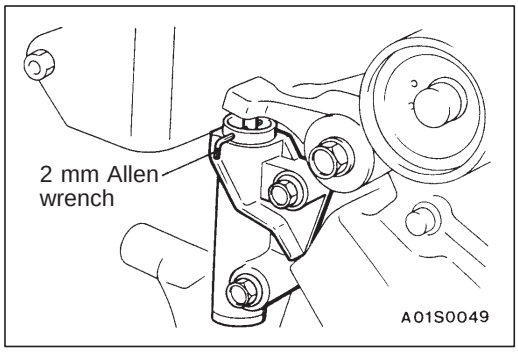


▶C◀ TIMING BELT TENSION ADJUSTMENT

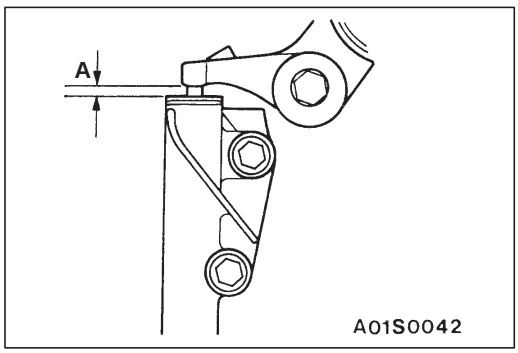
1. After turning the crankshaft a 1/4 turn anti-clockwise, turn it clockwise to the position where the timing marks are aligned.
2. Loosen the fixing bolt of the tensioner pulley and using the special tool and a torque wrench, apply tension to the timing belt; then tighten the fixing bolt at the specified torque.

   Standard Value:
   2.5 – 4.0 Nm {timing belt tension torque (reference value)}

   Caution
   When tightening the fixing bolt, ensure that the tensioner pulley shaft doesn't rotate with the bolt.



3. Take out the 2 mm Allen wrench from the auto tensioner. At this time, check to be sure that 2 mm Allen wrench can be pulled out easily.
   Turn the crankshaft clockwise 2 turns, and after leaving it in this position for 5 minutes or more, check again to be sure that the auto tensioner 2 mm Allen wrench can be pulled out or inserted easily.



NOTE
Even if the 2 mm Allen wrench cannot be easily inserted, then it is satisfactory if the amount of protrusion of the auto tensioner rod is within the standard value.

Standard value (A): 3.8 – 4.5 mm

If it is outside the standard value, repeat the operations in steps 1 to 4.

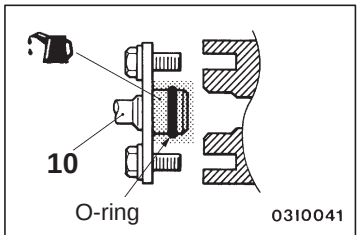
4. Check to be sure that the timing marks on all sprockets are aligned.

ENGINE ASSEMBLY

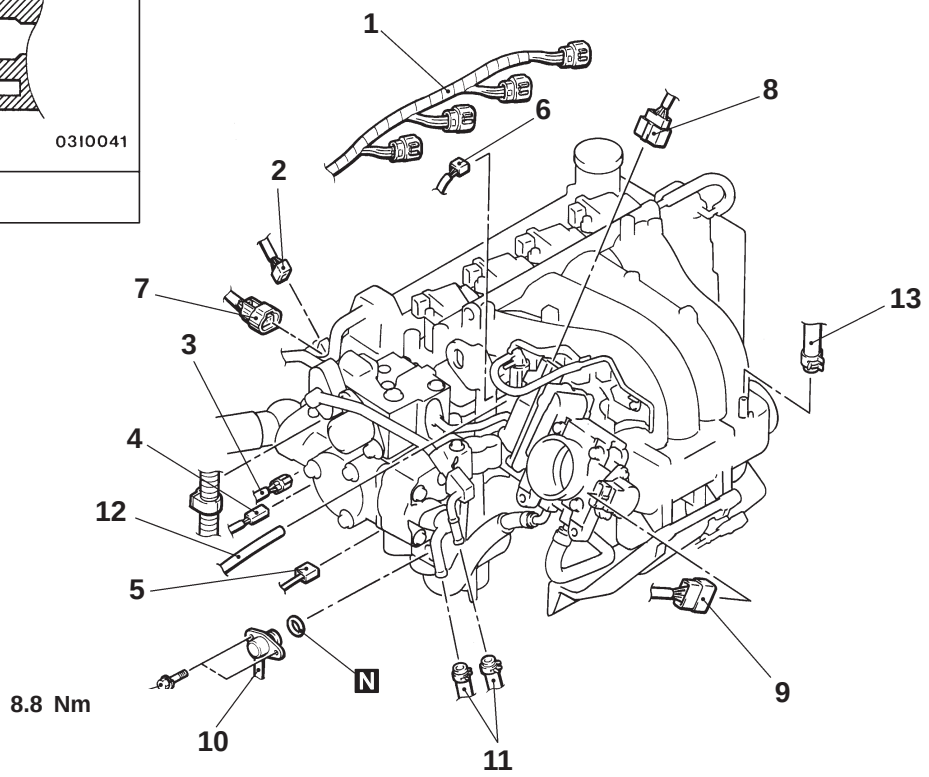
REMOVAL AND INSTALLATION

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

Pre-removal and Post-installation Operation
- Prevention of Fuel Discharge <before removal only> (Refer to GROUP 13A – On-vehicle Service.)
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Hood Removal and Installation (Refer to GROUP 42.)
- Drive Belt Tension adjustment <after installation only> (Refer to P.11A-7.)



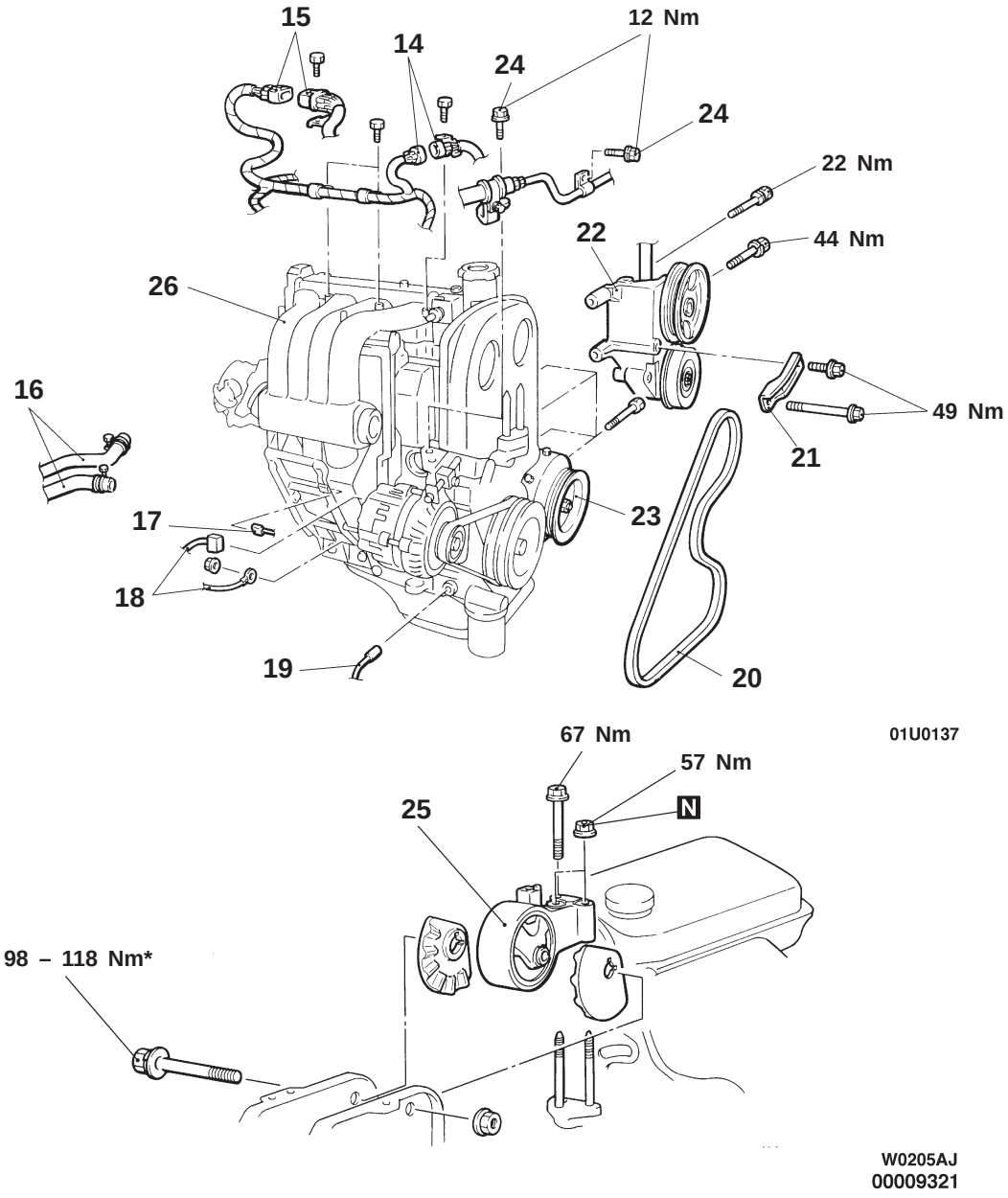
Engine oil



W0254AJ
00009320

Removal steps

1. Ignition coil connector
2. Cam position sensor connector
3. Engine coolant temperature sensor connector
4. Engine coolant temperature gauge unit connector
5. Detonation sensor connector
6. Purge solenoid valve connector
7. Fuel pressure sensor connector
8. Throttle valve control servo connector
9. Throttle position sensor connector
- ▶C◀ 10. High-pressure fuel hose connection
11. Fuel return hose connection
12. Vacuum hose connection
13. Brake booster vacuum hose connection



14. Crank angle sensor connector
15. Injector harness connector
16. Heater hose connection
17. Oxygen sensor connector
18. Alternator connector
19. Engine oil pressure switch connector
20. Drive belt (Power steering and A/C)
21. Power steering oil pump bracket stay

◀A▶
22. Power steering oil pump and bracket assembly

◀B▶
23. A/C compressor
24. Power steering hose mounting bolt
    - Transmission assembly (Refer to GROUP 22.)

◀C▶ ▶B◀ 25. Engine mount bracket
◀D▶ ▶A◀ 26. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

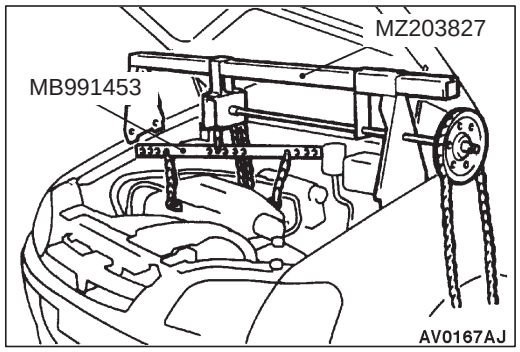
Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

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

◀B▶ A/C COMPRESSOR REMOVAL

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

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



◀C▶ ENGINE MOUNT BRACKET REMOVAL

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

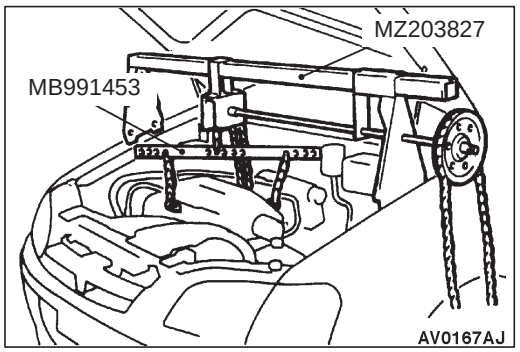
◀D▶ ENGINE ASSEMBLY REMOVAL

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

INSTALLATION SERVICE POINTS

▶A◀ ENGINE ASSEMBLY INSTALLATION

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



▶B◀ ENGINE MOUNT BRACKET INSTALLATION

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

▶C◀ FUEL HIGH PRESSURE HOSE INSTALLATION

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

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

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

NOTES

ENGINE <4G9>

CONTENTS

GENERAL

OUTLINE OF CHANGES

Since the resin intake manifold is adopted, the fuel system is changed, and the vehicle with A/T is added to the lineup, the following service adjustment procedures are made.
Other service procedures are the same as before.

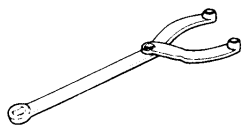
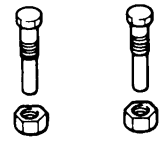
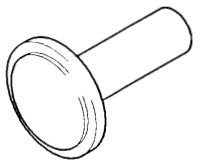
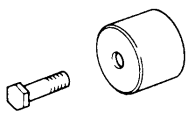
SERVICE SPECIFICATIONS

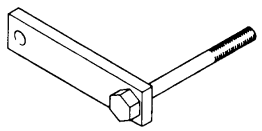
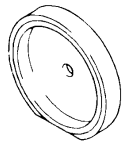
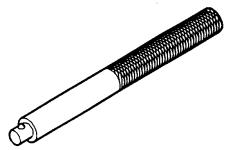
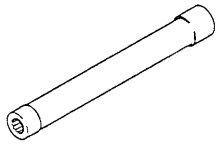
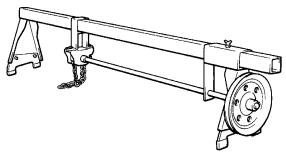
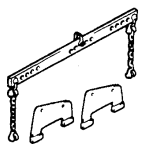
Items		Standard value	Limit
Idle speed r/min	A/T	650 ± 100	–
Cylinder head bolt shank length mm		–	96.4

SEALANTS

Items	Specified sealants	Remarks
Beam camshaft cap and cylinder head	3M ATD Part No.8660 or equivalent	Semi-drying sealant
Camshaft position sensor support	MITSUBISHI GENUINE PART MD970389 or equivalent	
Drive plate bolt	3M Stud locking 4170 or equivalent	–

SPECIAL TOOLS

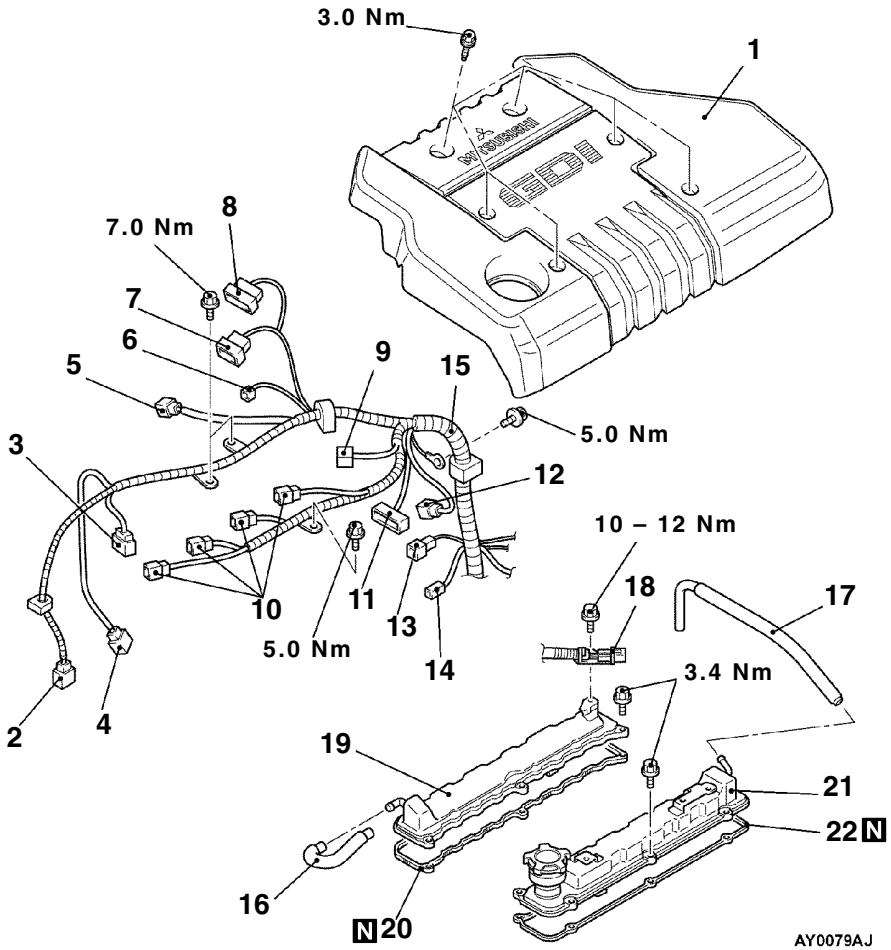
Tool	Number	Name	Use
	MB990767	End yoke holder	Holding the camshaft sprocket
	MD998719	Crankshaft pulley holder pin	Holding the camshaft sprocket
	MD998762	Circular packing installer	Press-fitting the circular packing
	MD998713	Camshaft oil seal installer	Press-fitting the camshaft oil seal

Tool	Number	Name	Use
	MD998781	Flywheel stopper	Securing the drive plate
	MD998776	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
	MB990938	Handle	
	MB991653	Cylinder head bolt wrench	Cylinder head bolt removal and installation
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
 B991453	MB991453	Engine hanger assembly	

CAMSHAFT AND CAMSHAFT OIL SEAL

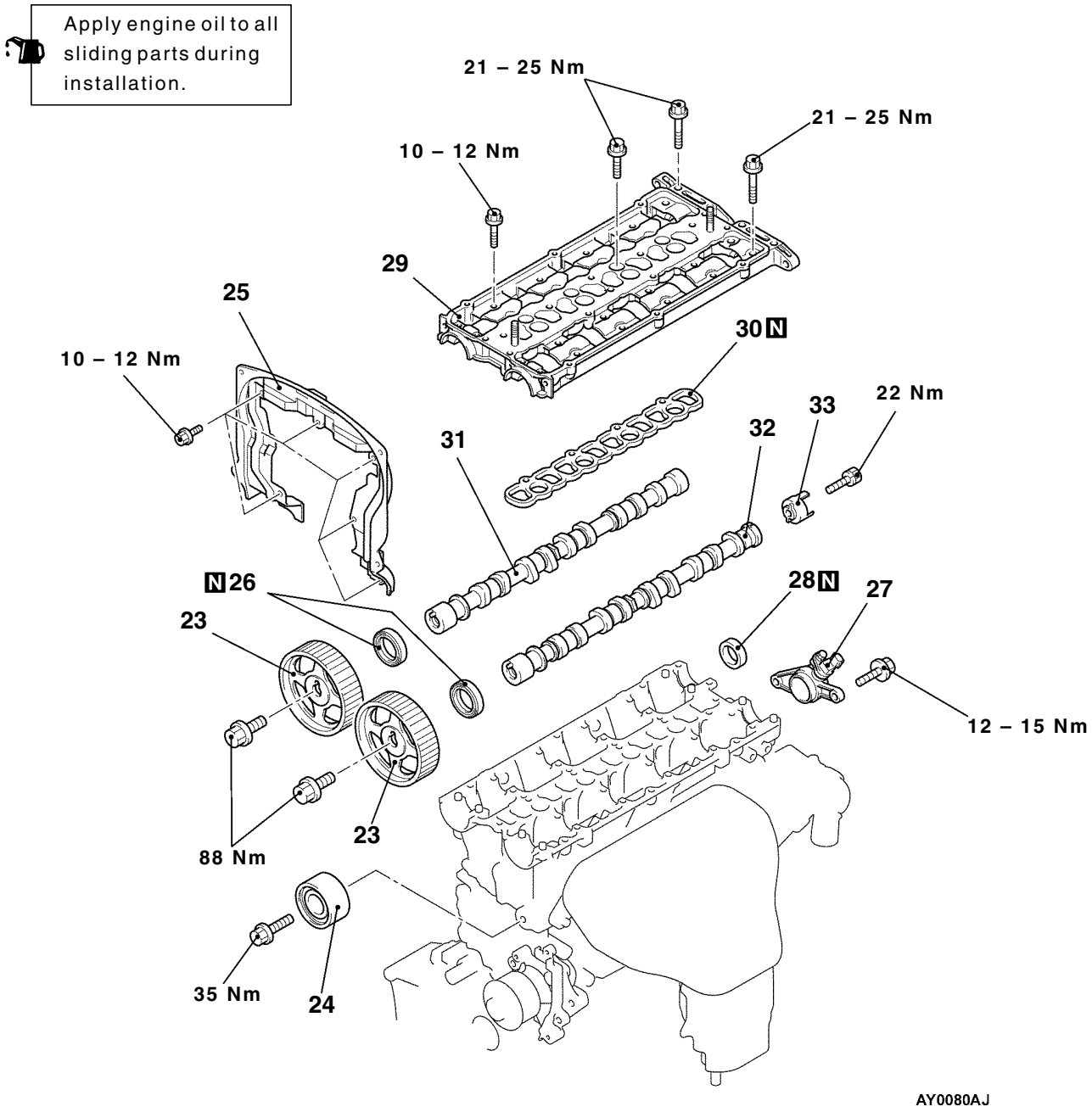
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- Air Bleeding the High Pressure Fuel Path <after installation only> [Refer to GROUP 13A – Fuel Pump (High pressure).]
- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying
- Air Cleaner Removal and Installation



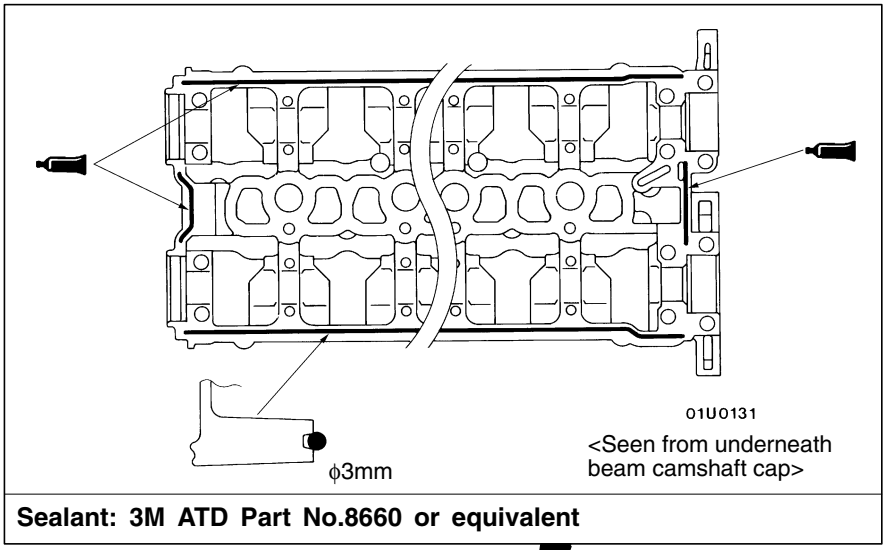
Removal steps

▶F◀ 1. Engine cover
2. Crank angle sensor connector
3. Fuel pressure sensor
4. Oxygen sensor (front) connector
5. Control wiring harness and EGR wiring harness combination connector
6. Purge control solenoid valve connector
7. Throttle position sensor connector
8. Throttle valve control servo connector
9. Control wiring harness and injector wiring harness combination connector
10. Ignition coil connector
11. Ignition failure sensor connector
12. Camshaft position sensor connector
13. Engine coolant temperature sensor connector
14. Engine coolant temperature gauge unit connector
15. Control wiring harness
16. PCV hose
17. Breather hose
    - Ignition coil (Refer to GROUP 16.
    - Intake manifold (Refer to GROUP 15.)
    - Timing belt
18. Connector bracket (injector wiring harness)
19. Rocker cover (intake side)
20. Rocker cover gasket
21. Rocker cover (exhaust side)
22. Rocker cover gasket

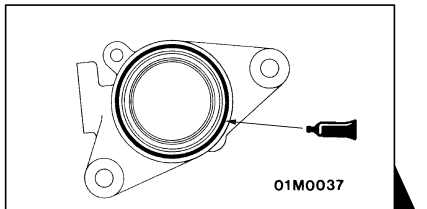


◀A▶ ▶E◀ 23. Camshaft sprocket
24. Idler pulley
25. Timing belt rear upper cover
▶D◀ 26. Camshaft oil seal
27. Camshaft position sensor support
▶C◀ 28. Circular packing
● Fuel pump (high pressure) assembly (Refer to GROUP 13A.)
▶B◀ 29. Beam camshaft cap
30. Beam camshaft cap gasket
▶A◀ 31. Camshaft (intake side)
▶A◀ 32. Camshaft (exhaust side)
33. Camshaft position sensing cylinder

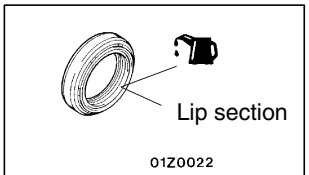
Lubrication points



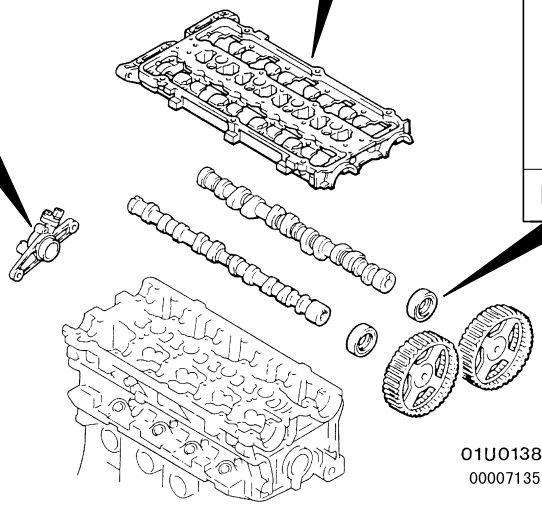
Sealant: 3M ATD Part No.8660 or equivalent

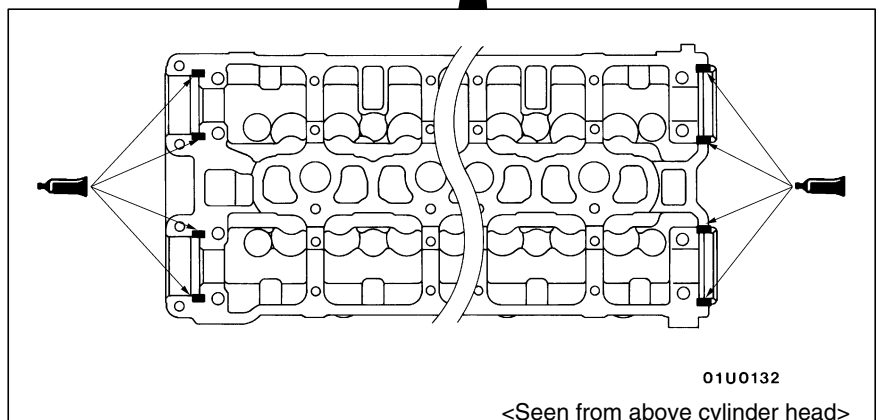


Sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent

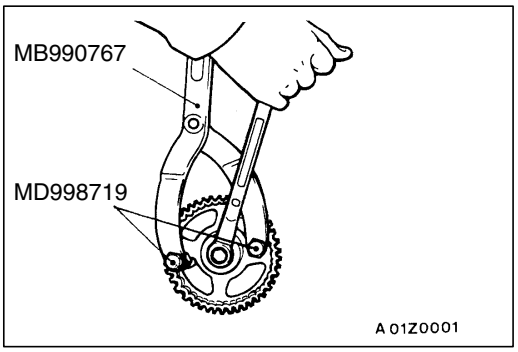


Engine oil



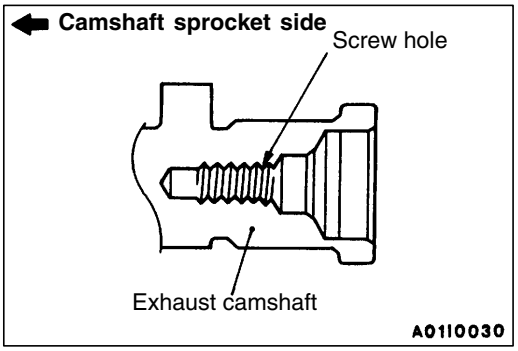


Sealant: 3M ATD Part No.8660 or equivalent



REMOVAL SERVICE POINT

◀A▶ CAMSHAFT SPROCKET REMOVAL

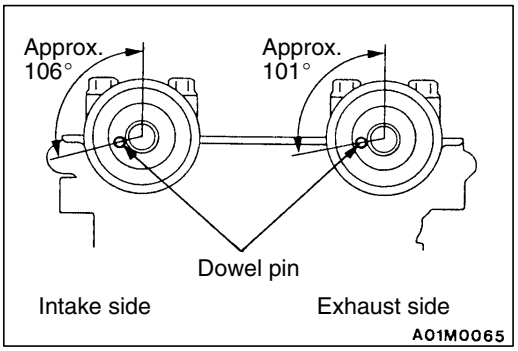


INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

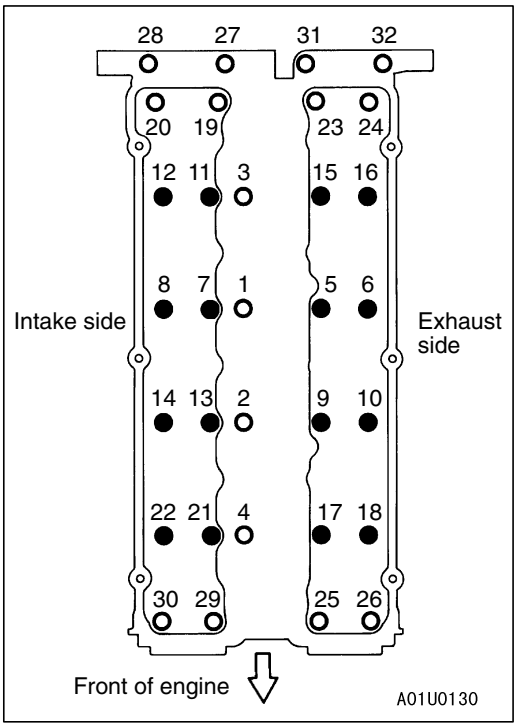
1. Apply engine oil to journals and cams of the camshafts.
2. Install the camshafts on the cylinder head.

Caution
Be careful not to confuse the intake camshaft with the exhaust one. There is a screw hole for the cam position sensing cylinder mounting bolt on the exhaust-side camshaft.



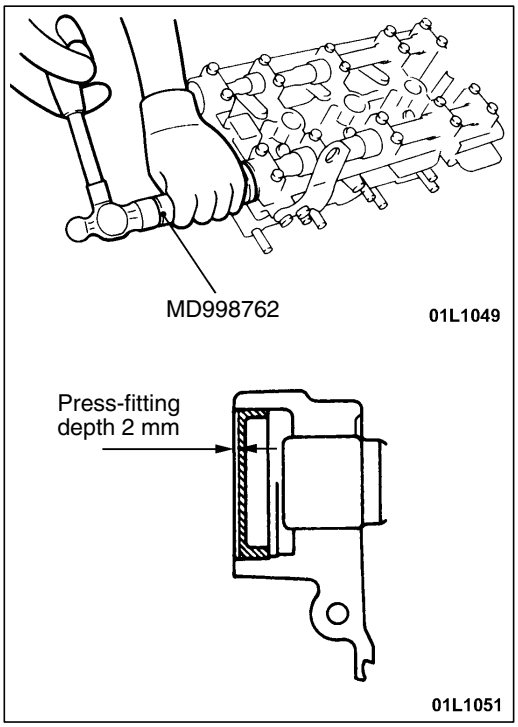
▶B◀ BEAM CAMSHAFT CAP INSTALLATION

1. Place the camshaft dowel pin as shown in the illustration.



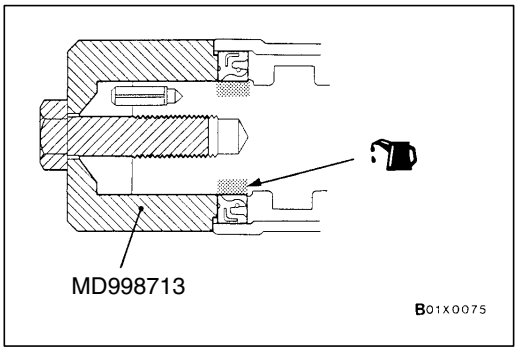
2. Tighten the beam camshaft cap mounting bolts to the specified torque in the order shown in the illustration.

Tightening torque:
● : 10 – 12 Nm
○ : 21 – 25 Nm



▶C◀ CIRCULAR PACKING INSTALLATION

Use the special tool to press-fit the circular packing as shown in the illustration.

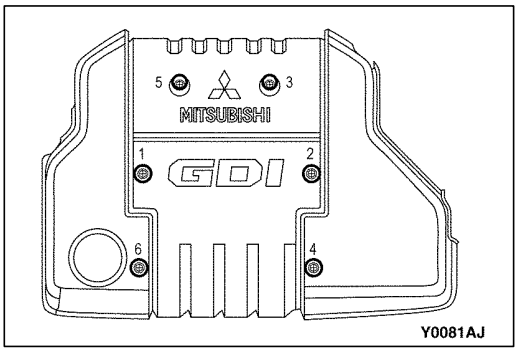


▶D◀ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the entire circumference of the oil seal lip.
2. Press-fit the oil seal as shown in the illustration.

▶E◀ CAMSHAFT SPROCKET INSTALLATION

Use the special tool to secure the camshaft sprocket in the same way as during removal, and then tighten the bolt to the specified torque.



▶F◀ ENGINE COVER INSTALLATION

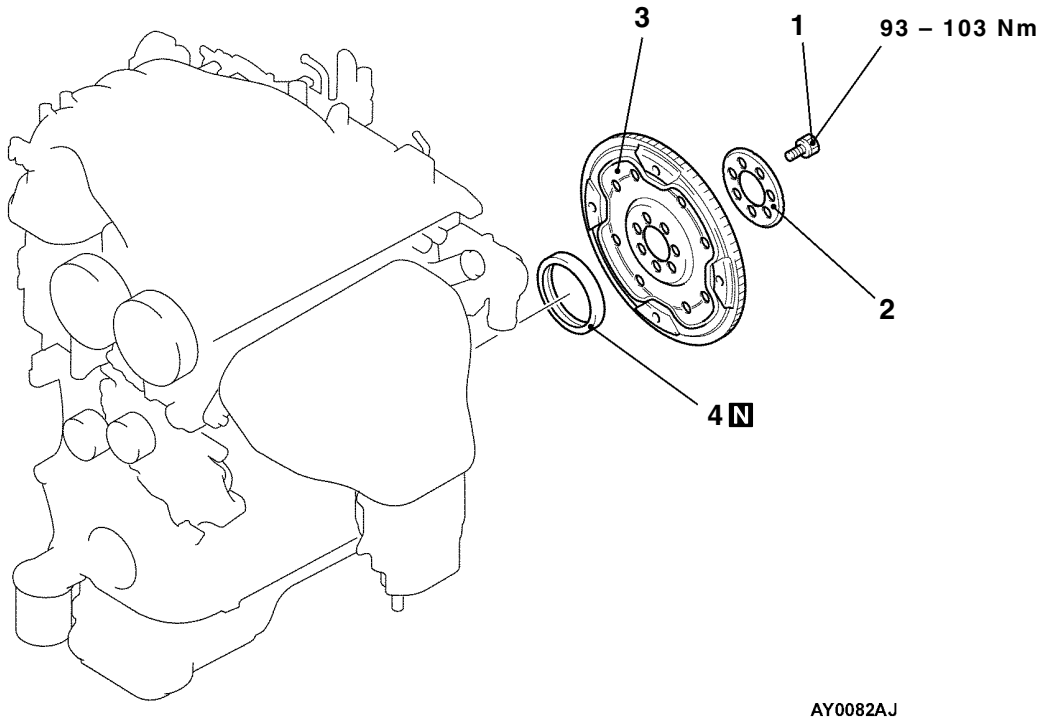
1. Temporarily tighten the mounting bolt in the order of the numbers shown in the illustration so that the engine cover can move easily by hand.
2. Tighten the mounting bolt to the specified torque in the order of the numbers shown in the illustration.

   Tightening torque: 3.0 Nm

CRANKSHAFT REAR OIL SEAL <A/T>

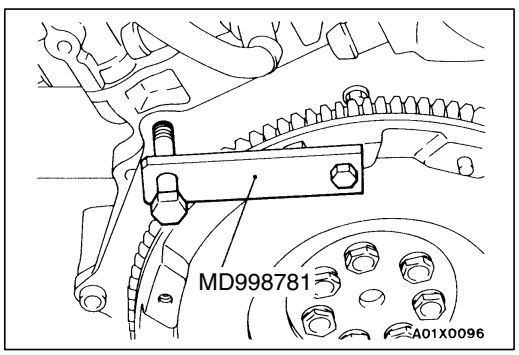
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Transmission Assembly Removal and Installation (Refer to GROUP 23.)



Removal steps

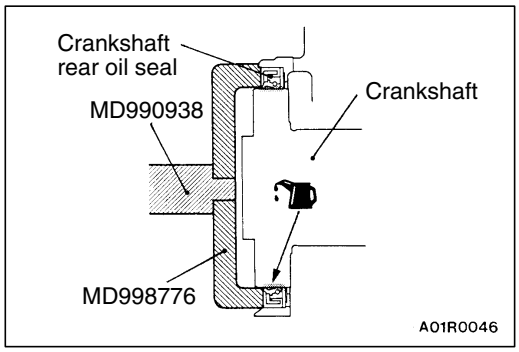
◀A▶ ▶B◀ 1. Drive plate bolts
▶B◀ 2. Adapter plate
▶B◀ 3. Drive plate
▶A◀ 4. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ DRIVE PLATE BOLTS REMOVAL

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



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT 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/ADAPTOR PLATE/DRIVE PLATE BOLTS INSTALLATION

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

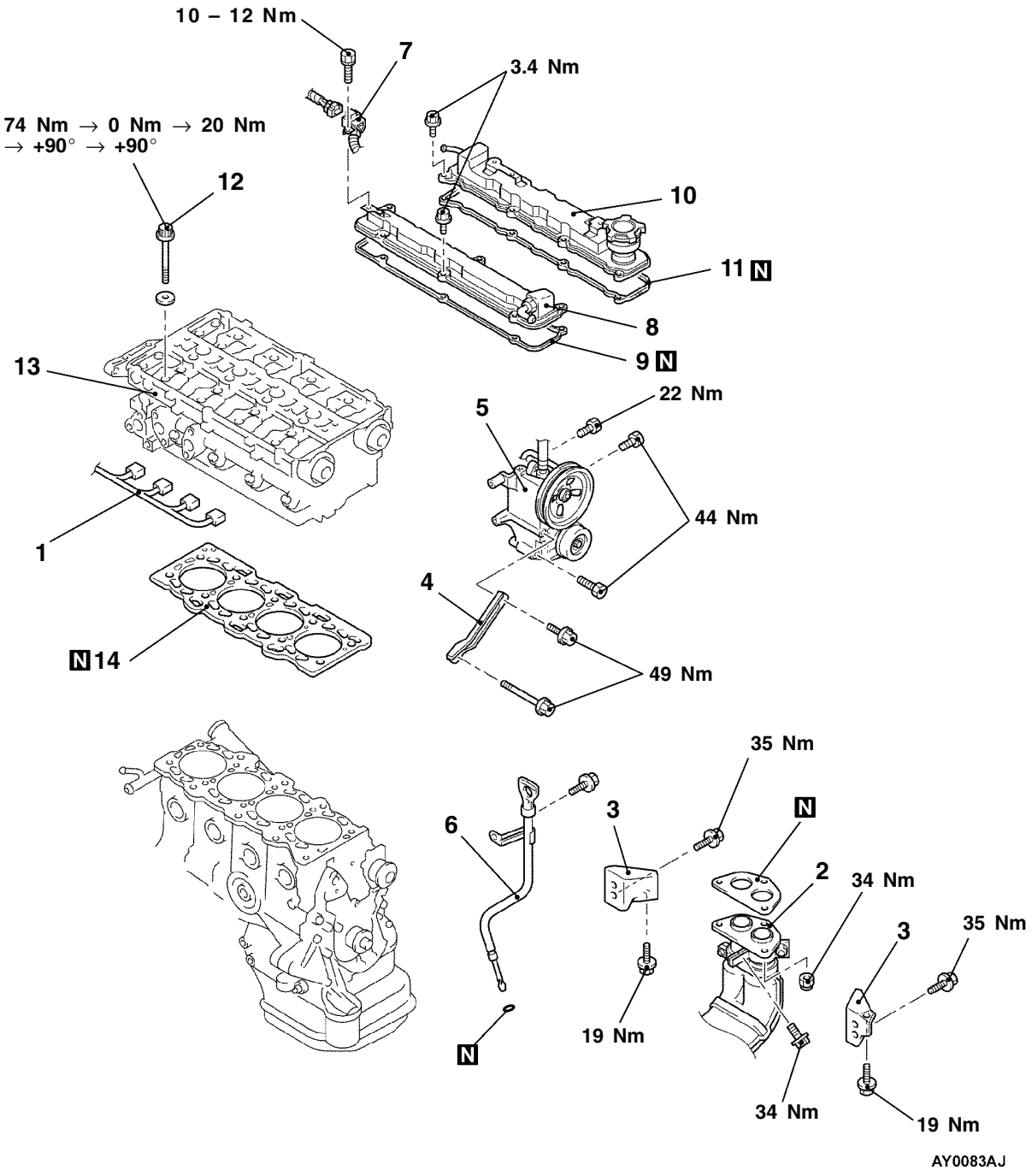
5. Use the special tool to secure the drive plate, and then tighten the bolts to the specified torque.

   Specified torque: 93 – 103 Nm

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation (Refer to P.11A-5.)
- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- Air Bleeding the High Pressure Fuel Path<after installation only> [Refer to GROUP 13A – Fuel Pump (High-pressure).]
- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying
- Engine Oil Draining and Supplying
- Air Cleaner Removal and Installation
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Pump (high-pressure) Assembly Removal and Installation (Refer to GROUP 13A.)
- Timing Belt Rear Upper Cover Removal and Installation (Refer to P.11A-5.)
- Thermostat Case Assembly and Radiator upper hose Removal and Installation (Refer to GROUP 14 – Water Hose and Water Pipe.)



Removal steps

1. Injector harness connector
2. Front exhaust pipe connection
3. Exhaust manifold bracket
4. Power steering oil pump bracket stay
◀A▶ 5. Power steering oil pump and bracket assembly
6. Engine oil level gauge assembly
7. Connector bracket (injector wiring harness)
8. Rocker cover (intake side)
9. Rocker cover gasket
10. Rocker cover (exhaust side)
11. Rocker cover gasket
◀B▶ ▶B◀ 12. Cylinder head bolt
13. Cylinder head assembly
▶A◀ 14. Cylinder head gasket

REMOVAL SERVICE POINTS

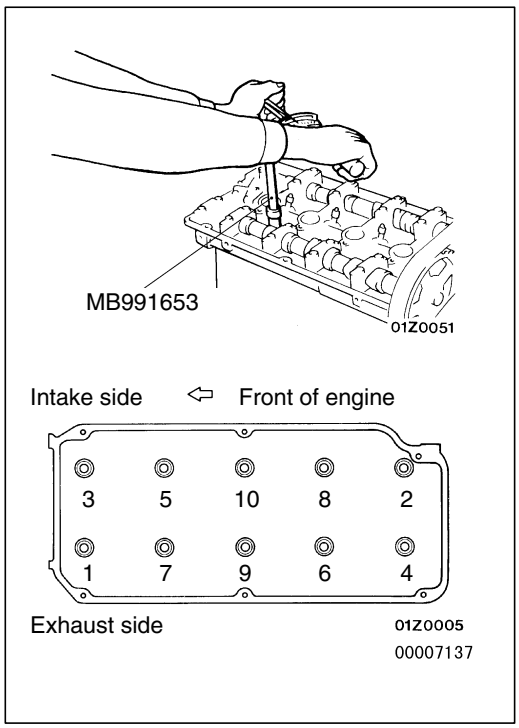
◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

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

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

◀B▶ CYLINDER HEAD BOLT REMOVAL

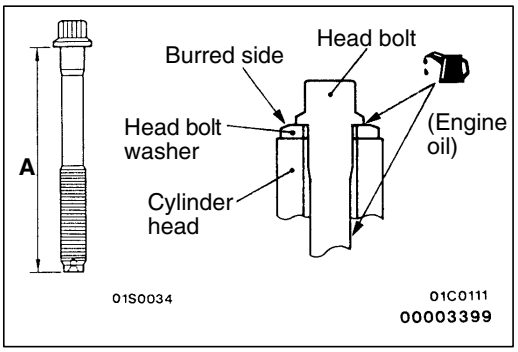
Use the special tool to loosen the bolts in two or three stages in the order of the numbers shown in the illustration, and then remove the bolts.

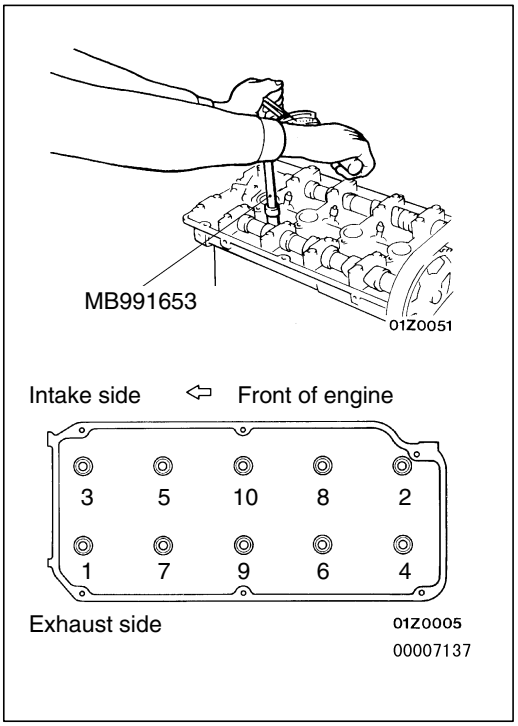


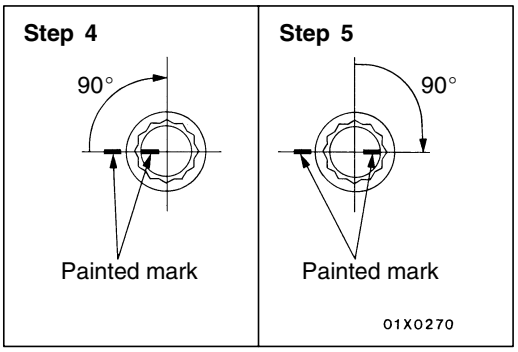
INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

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







▶B◀ CYLINDER HEAD BOLT INSTALLATION

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

   Limit (A): 96.4 mm

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

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

Caution

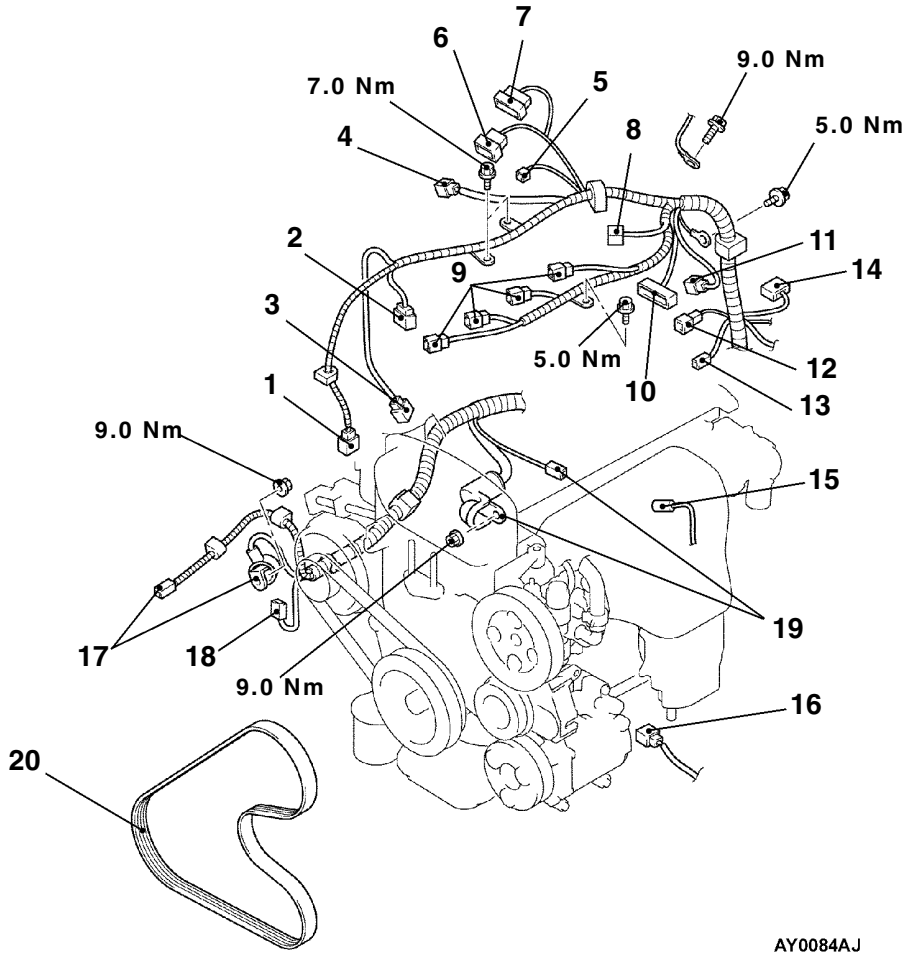
(1) Always make a tightening angle just 90°. If it is less than 90°, the head bolt will be loosened.

(2) If it is more than 90°, remove the head bolt and repeat the procedure from step 1.

ENGINE ASSEMBLY

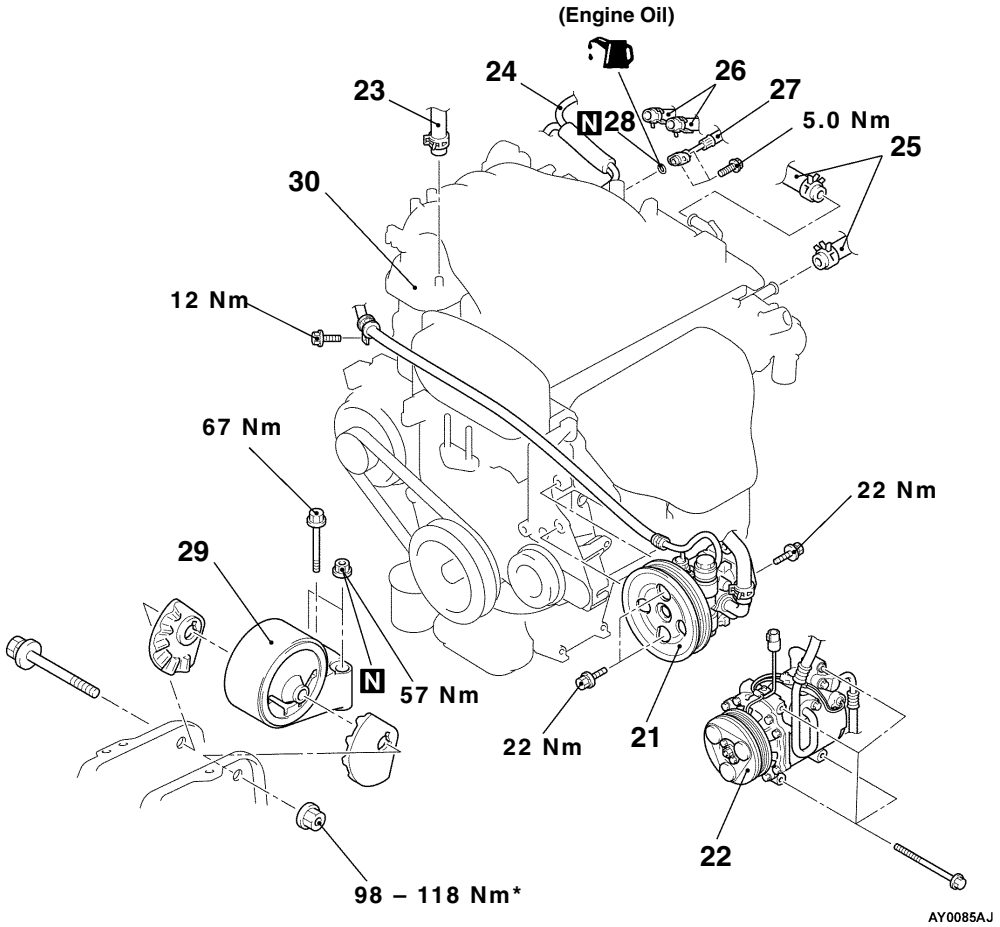
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation (Refer to P.11A-5.)
- Prevention of Fuel Discharge <before removal only>
- Air Bleeding the High Pressure Fuel Path <after installation only> [Refer to GROUP 13A – Fuel Pump (High pressure).]
- Fuel Leak Check <after installation only>
- Drive Belt Tension Adjustment
- Under Cover Removal and Installation
- Air Cleaner Removal and Installation
- Hood Removal and Installation
- Radiator Assembly Removal (Refer to GROUP 14.)



Removal steps
1. Crank angle sensor connector
2. Fuel pressure sensor
3. Oxygen sensor (front) connector
4. Control wiring harness and EGR wiring harness combination connector
5. Purge control solenoid valve connector
6. Throttle position sensor connector
7. Throttle valve control servo connector
8. Control wiring harness and injector wiring harness combination connector
9. Ignition coil connector
10. Ignition failure sensor connector
11. Camshaft position sensor connector
12. Engine coolant temperature sensor connector
13. Engine coolant temperature gauge unit connector
14. Detonation sensor connector
15. Power steering oil pressure switch connector
16. A/C compressor connector
17. Alternator connector
18. Engine oil pressure switch connector
19. Starter connector
20. Drive belt (Power steering and A/C)

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



◀A▶ 21. Power steering oil pump
◀B▶ 22. A/C compressor
23. Brake booster vacuum hose connection
24. Vacuum hose connection
25. Heater hoses connection
▶D◀ 26. Fuel return hoses connection
▶C◀ 27. High-pressure fuel hose connection
▶C◀ 28. O-ring
- Transmission assembly (Refer to '99 SPACE STAR Workshop Manual.) (Refer to GROUP 23. <A/T>)

◀C▶ ▶B◀ 29. Engine mount Bracket
◀D▶ ▶A◀ 30. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP REMOVAL

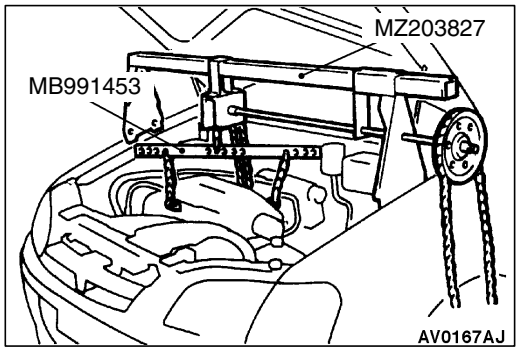
Remove the power steering oil pump from the engine with the hose attached.

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

◀B▶ A/C COMPRESSOR REMOVAL

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

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



◀C▶ ENGINE MOUNT BRACKET REMOVAL

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

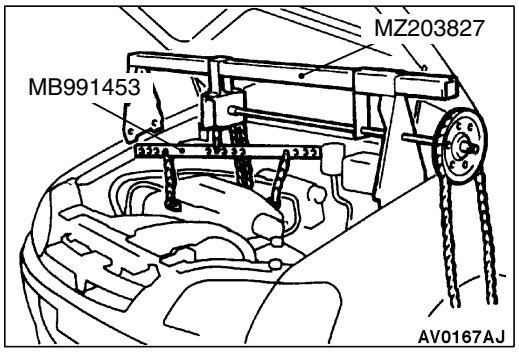
◀D▶ ENGINE ASSEMBLY REMOVAL

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

INSTALLATION SERVICE POINTS

▶A◀ ENGINE ASSEMBLY INSTALLATION

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



▶B◀ ENGINE MOUNT BRACKET INSTALLATION

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

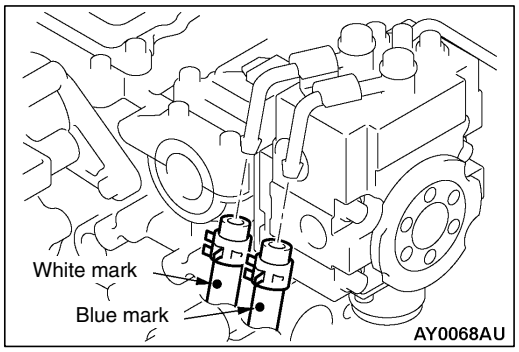
▶C◀ O-RING/HIGH-PRESSURE FUEL HOSE INSTALLATION

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.
4. Tighten to the specified torque.

   Specified torque: 5.0 Nm



▶D◀ FUEL RETURN HOSES INSTALLATION

Install so that the identification marks of the fuel return hoses are at the positions shown in the illustration.

SERVICE BULLETIN

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

SERVICE BULLETIN	**No.:** ESB-99E11-504	
	Date: 1999-07-15	**<Model>** (EC) SPACE STAR (DG0A) **<M/Y>** 99-10
Subject: CORRECTION IN CYLINDER HEAD BOLTS INSTALLING PROCEDURE		
Group: ENGINE		
INFORMATION	O. Kai - E.V.P. & G.M. After Sales Service Dept.	

1. Description:

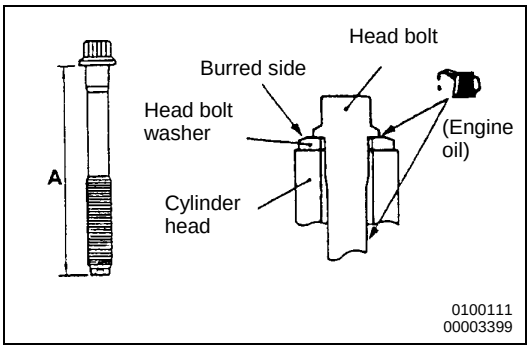
This service bulletin informs you of the Correction in cylinder head bolts installing procedure.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
'99 SPACE STAR Workshop Manual Chassis	CMXE99E1	(English)	11A-28
	CMXS99E1	(Spanish)	
	CMXF99E1	(French)	
	CMXG99E1	(German)	
	CMXD99E1	(Dutch)	
	CMXW99E1	(Swedish)	
	CMXI99E1	(Italian)	

3. Details:

Refer to the attached sheet.



CYLINDER HEAD BOLT INSTALLATION

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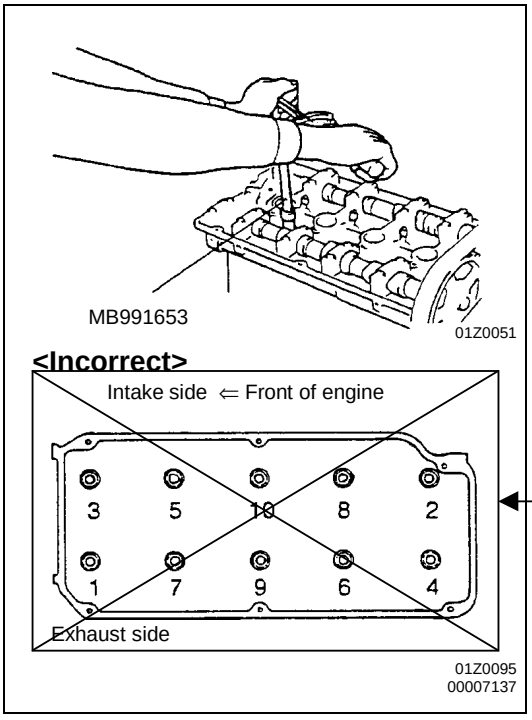

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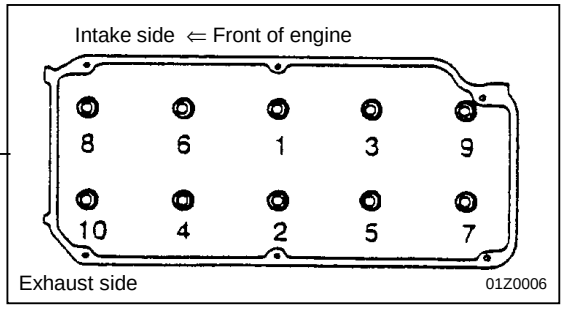

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