

ENGINE



CONTENTS

11109000832

ENGINE <6G7> 11A

ENGINE <4D5> 11B



ENGINE <6G7>

CONTENTS

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GENERAL INFORMATION	3	CRANKSHAFT PULLEY	18
SERVICE SPECIFICATIONS	4	CAMSHAFT	19
SEALANT	5	CAMSHAFT OIL SEAL	21
SPECIAL TOOLS	6	OIL PAN AND OIL SCREEN	23
ON-VEHICLE SERVICE	8	CYLINDER HEAD GASKET	25
Drive Belt Tension Check and Adjustment	8	TIMING BELT	28
Ignition Timing Check	12	CRANKSHAFT FRONT OIL SEAL	34
Idle Speed Check	12	CRANKSHAFT REAR OIL SEAL	35
Idle Mixture Check	13	ENGINE ASSEMBLY	36
Compression Pressure Check	13		
Manifold Vacuum Check	14		
Lash Adjuster Check	15		

GENERAL INFORMATION

11100010612

Items		Specifications
Total displacement mL		2,972
Bore x Stroke mm		91.1 x 76.0
Compression ratio		9.0
Combustion chamber		Pentroof type
Camshaft arrangement		SOHC
Number of valve	Intake	12
	Exhaust	12
Valve timing	Intake	Opening BTDC 19°, Closing ABDC 45°
	Exhaust	Opening BBDC 49°, Closing ATDC 15°
Fuel system		Electronic control multipoint fuel injection
Rocker arm		Roller type
Auto-lash adjuster		Equipped

SERVICE SPECIFICATIONS

11100030687

Items			Standard value	Limit
Alternator drive belt tension	Vibration frequency Hz	When checked	At A: 197 – 241 At B: 133 – 164	–
		When a used belt is installed	At A: 209 – 231 At B: 142 – 157	–
		When a new belt is installed	At A: 279 – 311 At B: 189 – 211	–
	Tension N	When checked	At A: 392 – 588 At B: 392 – 588	–
		When a used belt is installed	At A: 441 – 539 At B: 441 – 539	–
		When a new belt is installed	At A: 784 – 980 At B: 784 – 980	–
	Deflection (Reference value) mm	When checked	At A: 6.5 – 9.0 At B: 9.0 – 12.5	–
		When a used belt is installed	At A: 7.0 – 8.5 At B: 10.0 – 12.0	–
		When a new belt is installed	At A: 4.0 – 5.5 At B: 6.0 – 7.5	–
Power steering oil pump drive belt tension	Vibration frequency Hz	When checked	90 – 117	–
		When a used belt is installed	98 – 111	–
		When a new belt is installed	117 – 138	–
	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	13.0 – 17.0	–
		When a used belt is installed	14.0 – 16.0	–
		When a new belt is installed	11.0 – 13.0	–
A/C compressor drive belt tension	Vibration frequency Hz	When checked	207 – 232	–
		When a used belt is installed	207 – 232	–
		When a new belt is installed	243 – 264	–
	Tension N	When checked	392 – 490	–
		When a used belt is installed	392 – 490	–
		When a new belt is installed	539 – 637	–
	Deflection (Reference value) mm	When checked	5.6 – 6.4	–
		When a used belt is installed	5.6 – 6.4	–
		When a new belt is installed	4.3 – 5.1	–

Items	Standard value	Limit
Basic ignition timing mm	5° BTDC ± 3°	–
Ignition timing	Approx. 15° BTDC	–
Idle speed r/min	700 ± 100	–
CO contents %	0.5 or less	–
Compression pressure (at engine speed of 250 – 400 r/min) kPa	1,180	Min. 875
Compression pressure difference of all cylinder kPa	–	Max. 100
Intake manifold vacuum kPa	–	Min. 60
Auto tensioner rod depth (mm)	Within 1	–
Timing belt tension torque Nm	4.4	–
Auto tensioner rod protrusion amount mm	3.8 – 5.0	–

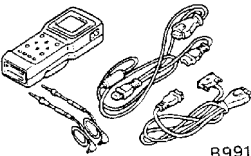
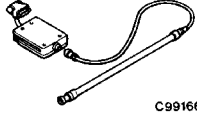
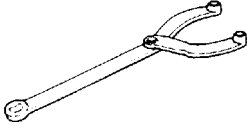
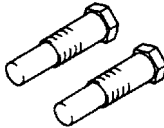
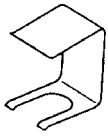
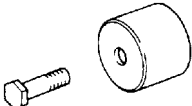
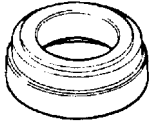
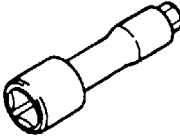
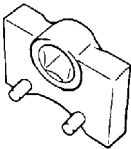
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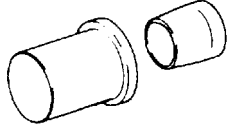

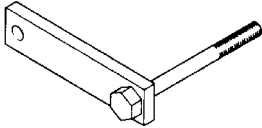
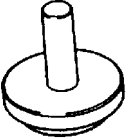
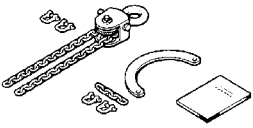
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Items	Specified sealant	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

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Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> ● Measuring drive belt tension ● Checking the ignition timing ● Checking the idle speed
 C991668	MB991668	Belt tension meter set	Measuring drive belt tension (used together with MUT-II)
	MB990767	End yoke holder	<ul style="list-style-type: none"> ● Supporting of crankshaft pulley ● Supporting of camshaft sprocket
	MD998715	Crankshaft pulley holder pin	
	MD998443	Auto-lash adjuster holder	Supporting of auto-lash adjuster
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
	MB991559	Camshaft oil seal adapter	Press-fitting the camshaft oil seal (left bank side)
	MD998051	Cylinder head bolt wrench	Removal and installation of the cylinder head bolt
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment

Tool	Number	Name	Use
	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
	MD998769	Crankshaft pulley spacer	Operating the crankshaft when installing the timing belt
	MD998781	Flywheel stopper	Securing the flywheel
	MD998718	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
 <p data-bbox="347 1125 412 1142">B991683</p>	MB991683	Sling chain set	Removal and installation of engine assembly

ON-VEHICLE SERVICE

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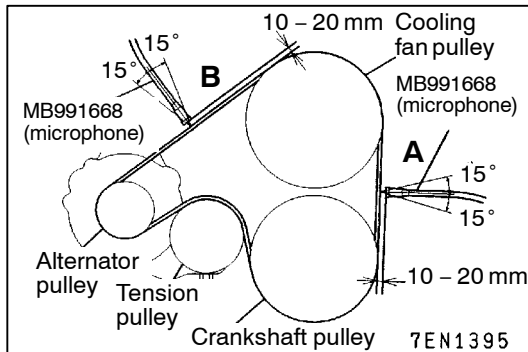
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Inspect the drive belt following the instructions below.

Standard value:

Vibration frequency Hz	At A	197 – 241
	At B	133 – 164
Tension N	At A	392 – 588
	At B	392 – 588
Deflection (Reference value) mm	At A	6.5 – 9.0
	At B	9.0 – 12.5

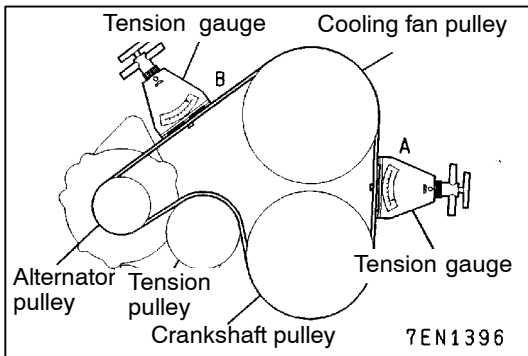


<When using MUT-II>

1. Connect the special tool (belt tension meter set) to the MUT-II.
2. Connect the MUT-II to the diagnosis connector.
3. Turn on the ignition switch and select "Belttension measurement" from the MUT-II menu screen.
4. As shown in the illustration, keep the microphone (MB991668) 10 to 20mm away from the back side of the belt perpendicularly (within an inclination of ± 15 degrees).
5. With your finger tip lightly tap the centre of the belt between the pulleys in the location shown by the arrow in the illustration to check whether the belt frequency is within the standard.

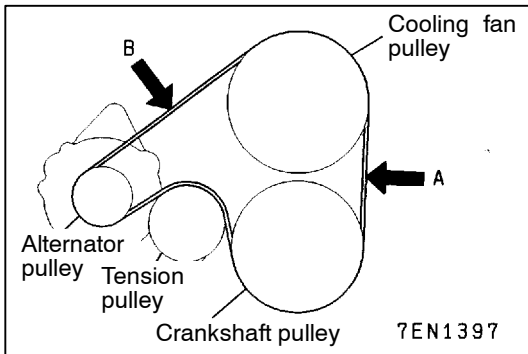
Caution

1. Measure when the belt surface temperature is close to room temperature.
2. Make sure that water or oil, etc., does not get on the microphone.
3. If a strong wind blows or noise is made close to the microphone during measure, the meter will show a value that differs from the actual value.
4. If the measurement is taken with the microphone touching the belt, the meter will show a value that differs from the actual value.
5. Do not measure while the engine is running.



<When using a tension meter>

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



<When checking the deflection>

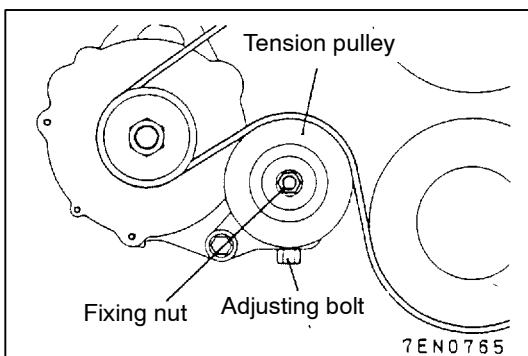
Apply 98N of pressure against the location between the pulleys shown by the arrow in the illustration to check if the deflection is within the standard value.

ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the alternator pivot bolt.
2. Loosen the lock bolt.
3. Turn the adjusting bolt to adjust the belt tension frequency, to put the belt tension or deflection within the standard value.

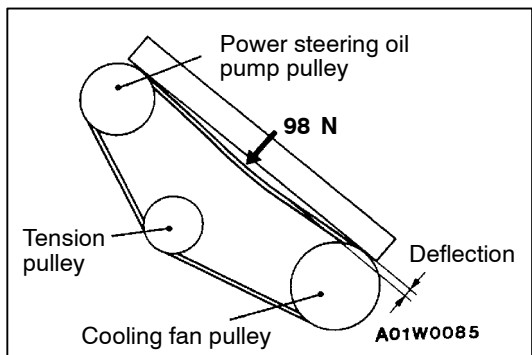
Standard value:

Items		When a used belt is installed	When a new belt is installed
Vibration frequency	At A	209 – 231	279 – 311
	At B	142 – 157	189 – 211
Tension N	At A	441 – 539	784 – 980
	At B	441 – 539	784 – 980
Deflection mm (reference value)	At A	7.0 – 8.5	4.0 – 5.5
	At B	10.0 – 12.0	6.0 – 7.5



4. Tighten the fixing nut.

Tightening torque: 49 Nm



POWER STEERING OIL PUMP DRIVE BELT TENSION CHECK AND ADJUSTMENT

11100110237

1. Check if the belt tension is within the standard value using one of the methods below.

Standard value:

Items	When checked	When a new belt is installed	When a used belt is installed
Vibration frequency Hz	90 – 117	117 – 138	98 – 111
Tension N	294 – 490	490 – 686	343 – 441
Deflection (reference value) mm	13.0 – 17.0	11.0 – 13.0	14.0 – 16.0

<When measuring the vibration frequency>

With your finger tip lightly tap the centre of the belt between the pulleys in the location shown by the arrow in the illustration and then measure the belt vibration frequency.

NOTE

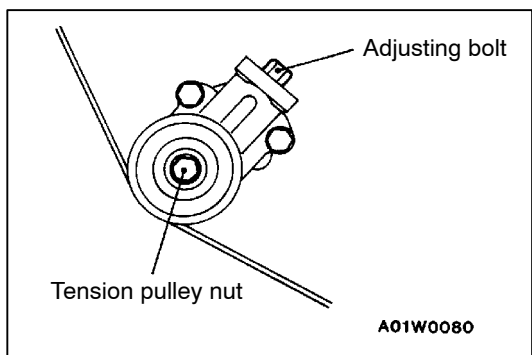
Refer to P.11A-8 for information regarding the vibration frequency measurement method using the MUT-II.

<When measuring the tension>

Use a belt tension gauge to measure the belt tension.

<When measuring the deflection>

Apply 98N of pressure against the location between the pulleys shown by the arrow in the illustration and then measure the deflection.



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

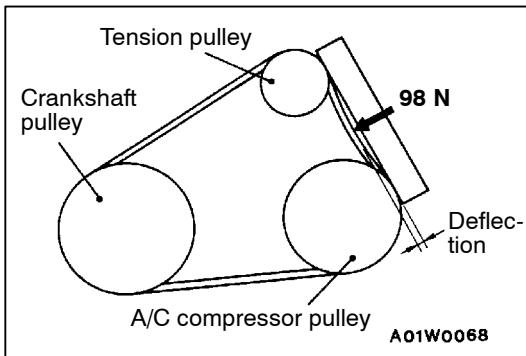
- (1) Loosen the tension pulley nut.
- (2) Adjust the amount of belt deflection using adjusting bolt.
- (3) Tighten the tension pulley nut.

Tightening torque: 48 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).



AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

11100100265

1. Check if the belt tension is within the standard value using one of the methods below.

Standard value:

Items	When checked	When a new belt is installed	When a used belt is installed
Vibration frequency Hz	207 – 232	243 – 264	207 – 232
Tension N	392 – 490	539 – 637	392 – 490
Deflection (reference value) mm	5.6 – 6.4	4.3 – 5.1	5.6 – 6.4

<When measuring the vibration frequency>

With your finger tip lightly tap the centre of the belt between the pulleys in the location shown by the arrow in the illustration and then measure the belt vibration frequency.

NOTE

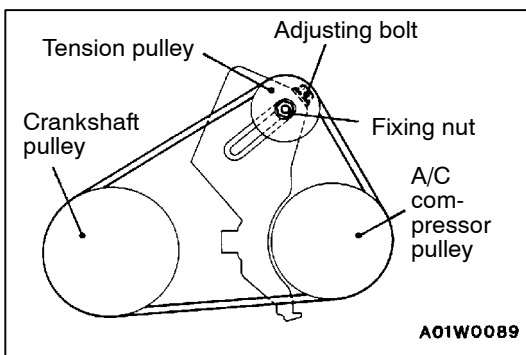
Refer to P.11A-8 for information regarding the vibration frequency measurement method using the MUT-II.

<When measuring the tension>

Use a belt tension gauge to measure the belt tension.

<When measuring the deflection>

Apply 98N of pressure against the location between the pulleys shown by the arrow in the illustration and then measure the deflection.



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

11100170488

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: 700 ± 100 r/min

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

Standard value: 5° BTDC ± 3°

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

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. 15° 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

11100190590

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: 700 ± 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

11100210548

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 2500 r/min for 2 minutes.
5. Set the CO, HC tester.
6. Check the CO contents and the HC contents at idle.

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
 - Evaporative emission control system
 - Compression pressure

NOTE

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

COMPRESSION PRESSURE CHECK

11100260703

1. Before inspection, check engine oil, the starter and battery are normal. Also, set the vehicle to the pre-inspection condition.
2. Remove all the spark plugs.
3. Disconnect the crankshaft angle sensor connector.

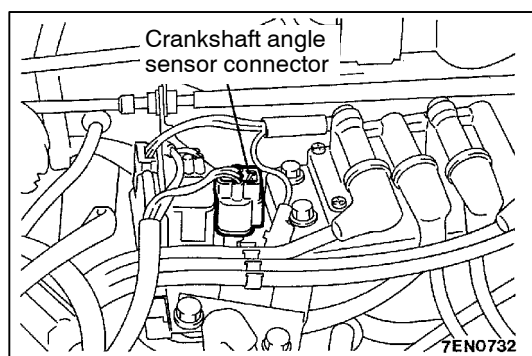
NOTE

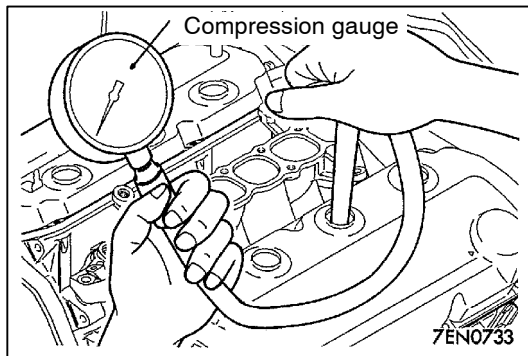
Doing this will prevent the engine control unit from carrying out ignition and fuel injection.

4. Cover the spark plug hole with a shop towel etc. and crank the engine. Then 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 hole.
6. Turn over the engine and measure the compression pressure.

Standard value (at engine speed of 250 – 400 r/min):
1,180 kPa

Limit (at engine speed of 250 – 400 r/min):
Min. 875 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 step 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.
 Use the MUT-II to erase the self-diagnosis codes or disconnect the battery cable from the battery (-) terminal for 10 seconds or more and then reconnect the cable.

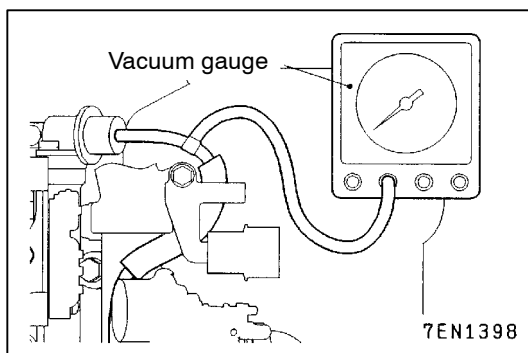
NOTE

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

MANIFOLD VACUUM CHECK

11100270577

1. Start the engine and allow it to warm up until the temperature of the engine coolant reaches 85 to 95°C.
2. Connect the MUT-II to the diagnosis connector.



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.

Standard value: 700 ± 100 r/min

5. Check the intake manifold vacuum.

Limit: Min. 60 kPa

LASH ADJUSTER CHECK

11100290672

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.

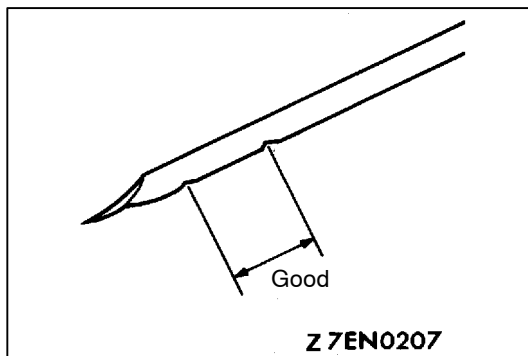
If the noise has become smaller or has disappeared, the cause of the noise was probably that oil sludge had caused the lash adjusters to become stuck. If this happens, clean the lash adjusters (Refer to Engine Workshop Manual). If the noise level does not change, go to step 5.

5. Bleed the air from the lash adjusters. (Refer to P.11A-16.)
6. If the noise does not disappear even after the air has been bled from the lash adjusters, clean the lash adjusters (Refer to Engine Workshop Manual).

<LASH ADJUSTER AIR BLEEDING>

NOTE

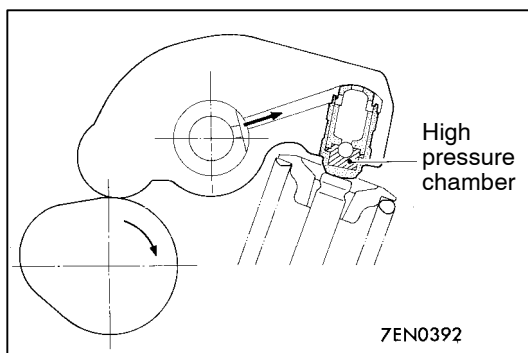
- (1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
- (2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes 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.



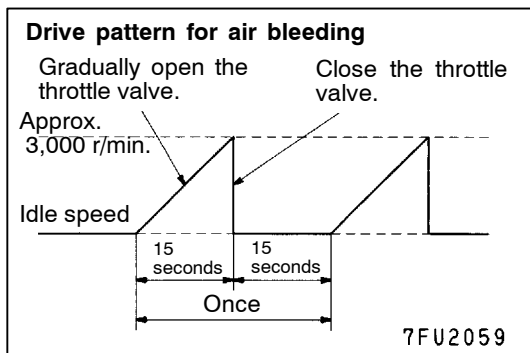
1. Check the engine oil and replenish or replace the oil if necessary.

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 be 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

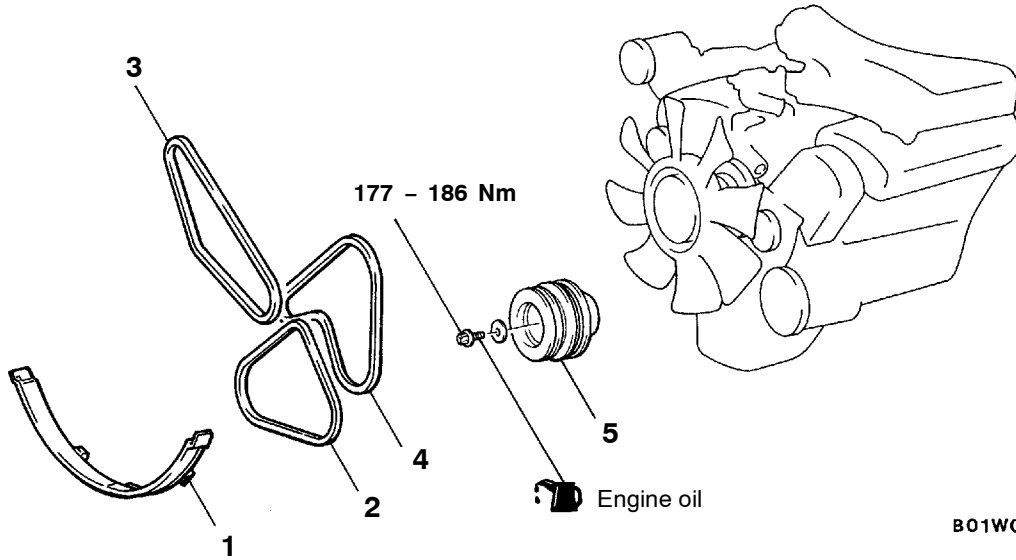
REMOVAL AND INSTALLATION

Pre-removal Operation

- Skid Plate and Under Cover Removal

Post-installation Operation

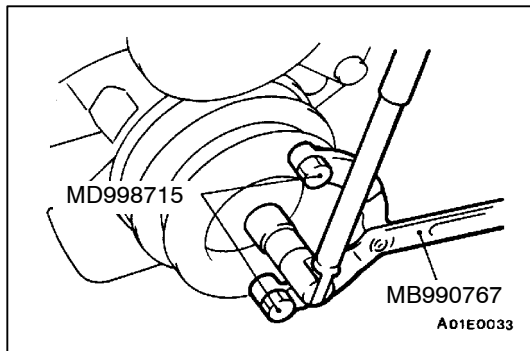
- Drive Belt Tension Adjustment (Refer to P.11A-8.)
- Skid Plate and Under Cover Installation



B01W0059

Removal steps

1. Radiator shroud cover
2. Drive belt (for A/C)
3. Drive belt (for power steering oil pump)
4. Drive belt (for alternator)
5. Crankshaft pulley



REMOVAL SERVICE POINT

◀▶ CRANKSHAFT PULLEY REMOVAL

Use special tools to remove the crankshaft pulley from the crankshaft.

INSTALLATION SERVICE POINT

▶A◀ CRANKSHAFT PULLEY INSTALLATION

Use special tools in the same way as during removal to install the crankshaft pulley.

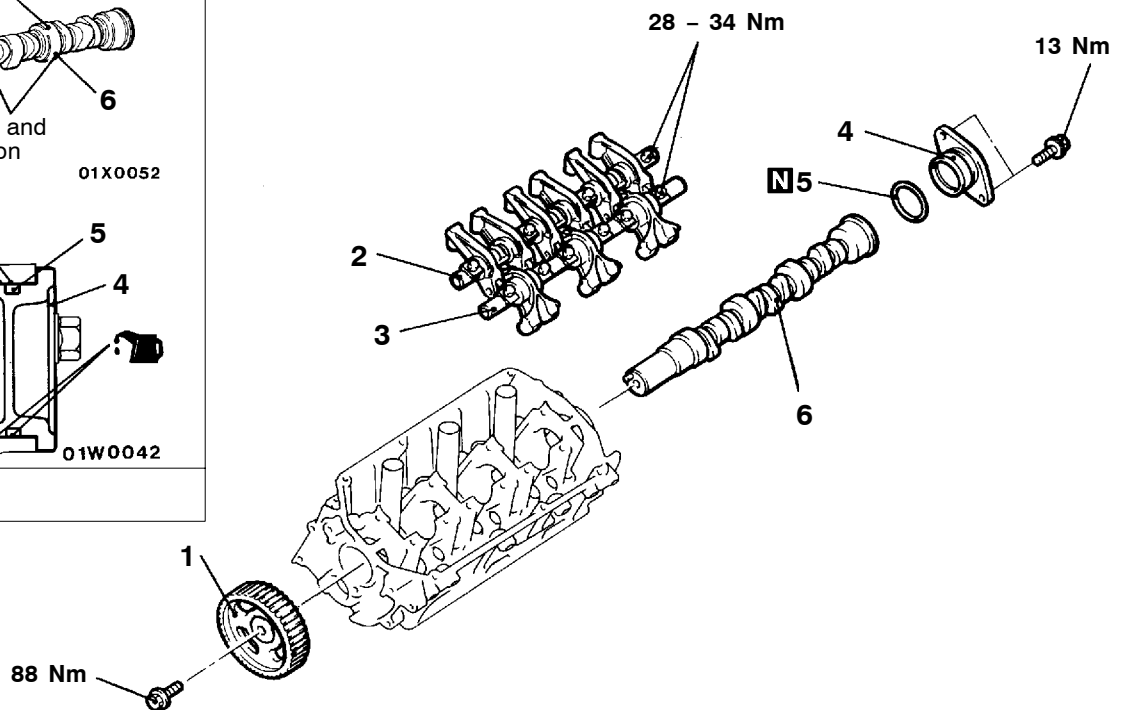
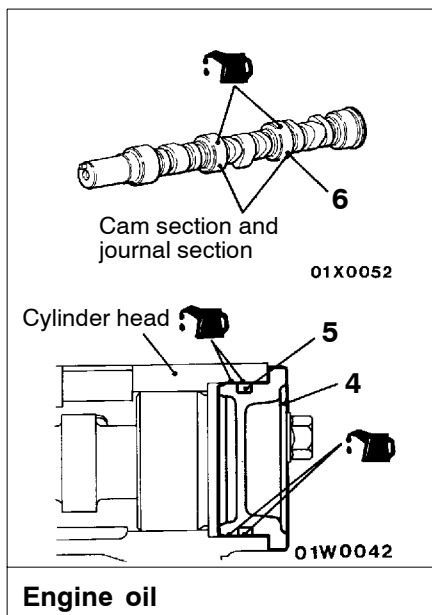
CAMSHAFT

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REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

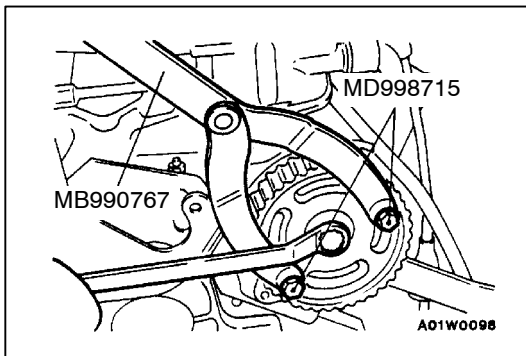
- Cylinder Head Assembly Removal and Installation (Refer to P.11A-25.)



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Removal steps

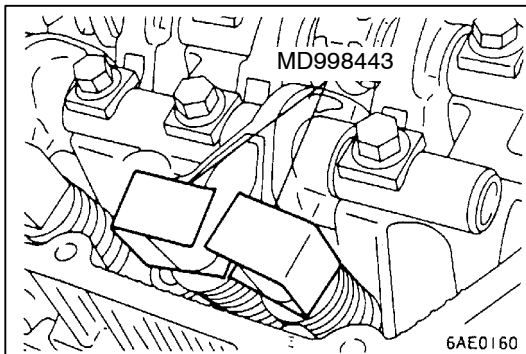
- | | | |
|-----|-----|---|
| ◀A▶ | ▶B◀ | 1. Camshaft sprocket |
| ◀B▶ | ▶A◀ | 2. Rocker arm and shaft assembly (intake side) |
| ◀B▶ | ▶A◀ | 3. Rocker arm and shaft assembly (exhaust side) |
| | | 4. Thrust case |
| | | 5. O-ring |
| | | 6. Camshaft |



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

Use special tools to remove the camshaft sprocket.

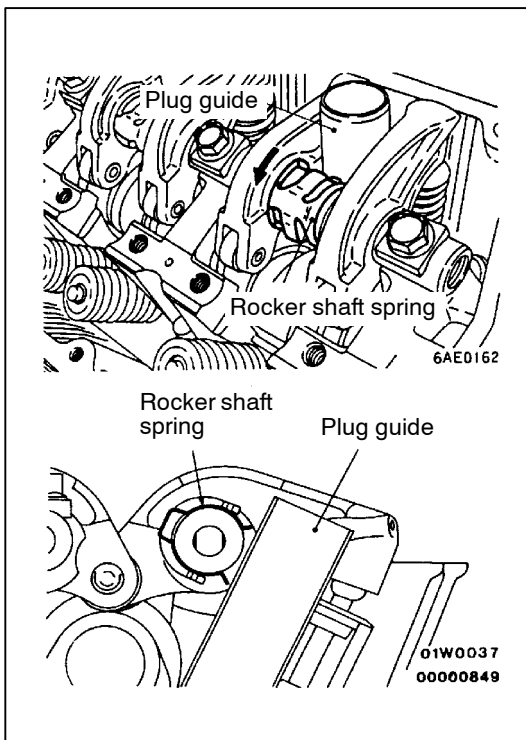


◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

1. Install special tool 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▶ 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. Tighten the rocker arm and shaft assembly mounting bolt to the specified torque.

Tightening torque: 28 – 34 Nm

4. Remove the special tool for fixing the lash adjuster.

►B◄ CAMSHAFT SPROCKET INSTALLATION

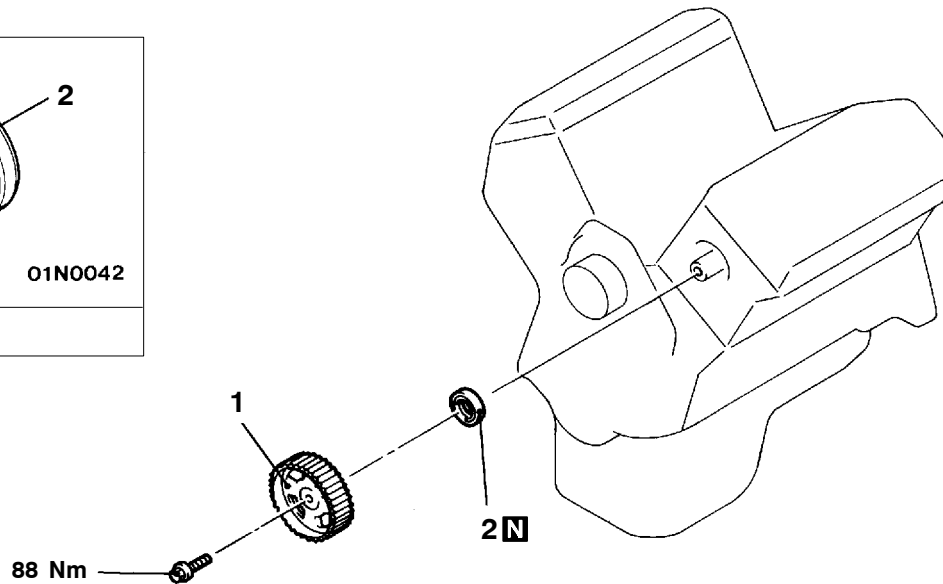
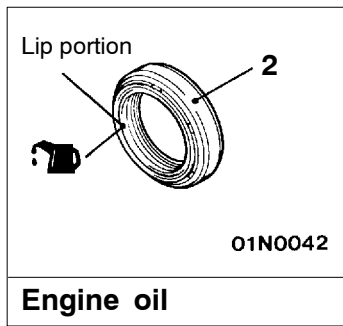
Use special tools in the same way as during removal to install the camshaft sprocket.

**CAMSHAFT OIL SEAL
REMOVAL AND INSTALLATION**

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Pre-removal and Post-installation Operation

- Timing Belt Removal and Installation
(Refer to P.11A-28.)



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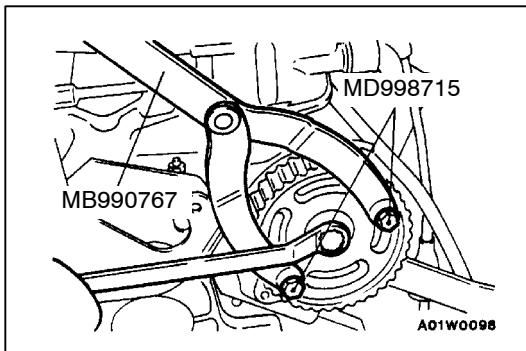
Removal steps

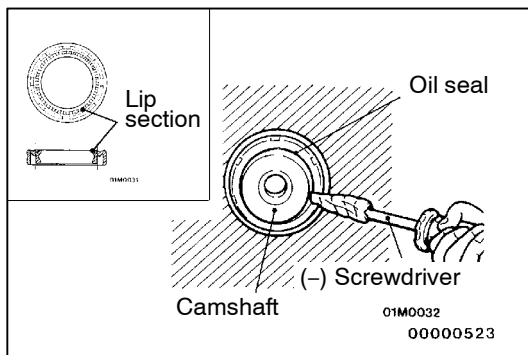
- ◄A► ►B◄ 1. Camshaft sprocket
◄B► ►A◄ 2. Camshaft oil seal

REMOVAL SERVICE POINTS

◄A► CAMSHAFT SPROCKET REMOVAL

Use special tools to remove the camshaft sprocket.



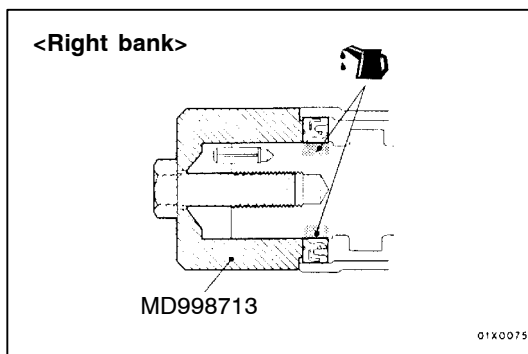


◀B▶ CAMSHAFT OIL SEAL REMOVAL

1. Make a notch in the oil seal lip section with a knife, etc.
2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the oil seal, and pry out the oil seal to remove it.

Caution

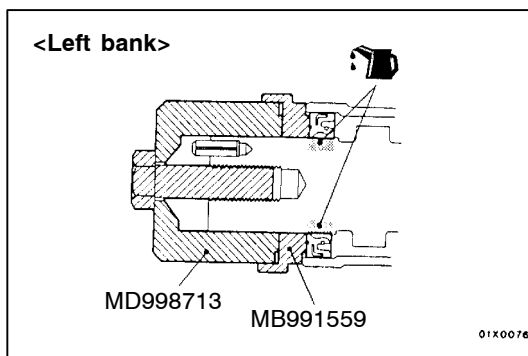
Be careful not to damage the camshaft and the cylinder head.



INSTALLATION SERVICE POINTS

▶A▶ CAMSHAFT OIL SEAL INSTALLATION

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



▶B▶ CAMSHAFT SPROCKET INSTALLATION

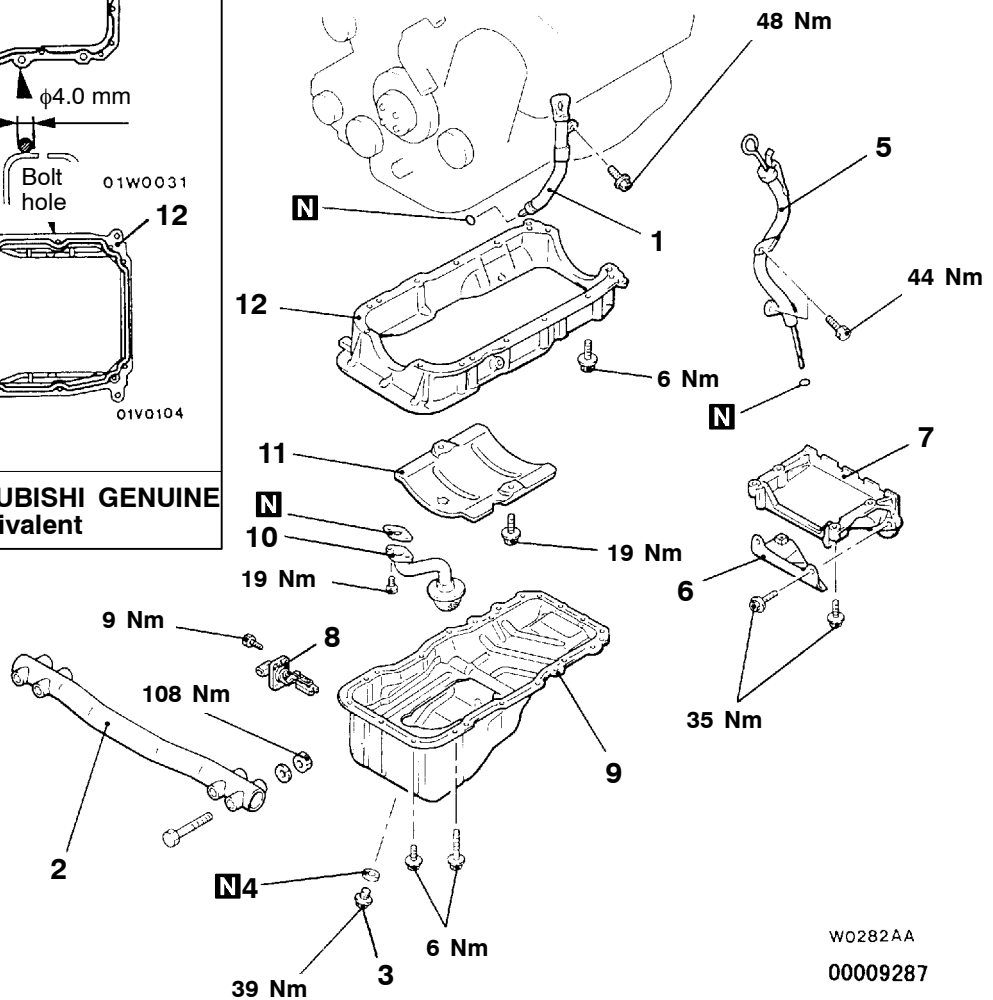
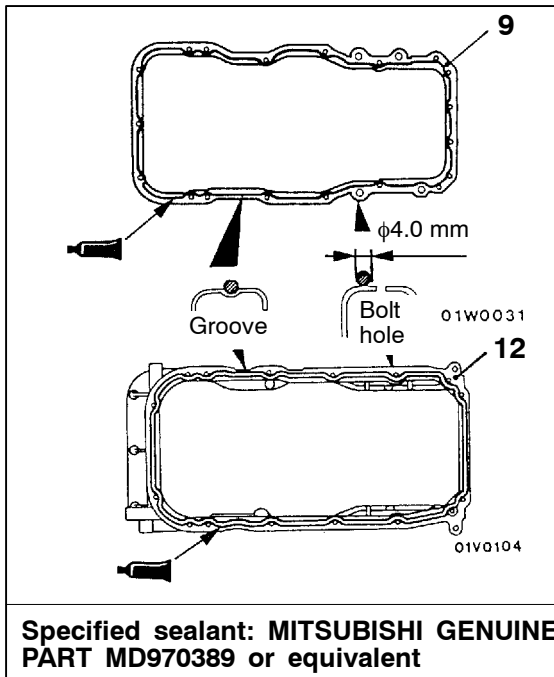
Use special tools in the same way as during removal to install the camshaft sprocket.

OIL PAN AND OIL SCREEN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

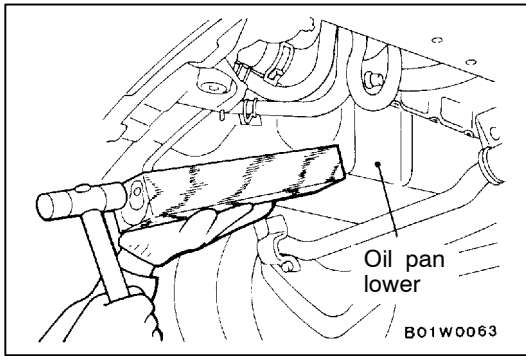
- Skid Plate and Under Cover Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 – On-vehicle Service.)
- Alternator Removal and Installation (Refer to GROUP 16 – Alternator.)
- Stabilizer Bar Removal and Installation (Refer to GROUP 33A – Stabilizer Bar.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)
- Actuator Assembly and Heat Protector Removal and Installation (Refer to GROUP 26 – Inner Shaft.)



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Removal steps

- | | | | |
|-----|---------------------------------|-----|----------------------|
| ▶C◀ | 1. Oil dipstick assembly | ▶B◀ | 7. Transmission stay |
| | 2. Crossmember assembly | ▶A◀ | 8. Oil level sensor |
| | 3. Drain plug | ▶A◀ | 9. Oil pan lower |
| | 4. Drain plug gasket | ▶A◀ | 10. Oil screen |
| | 5. A/T oil dipstick assembly | | 11. Baffle plate |
| | 6. Exhaust pipe support bracket | | 12. Oil pan upper |



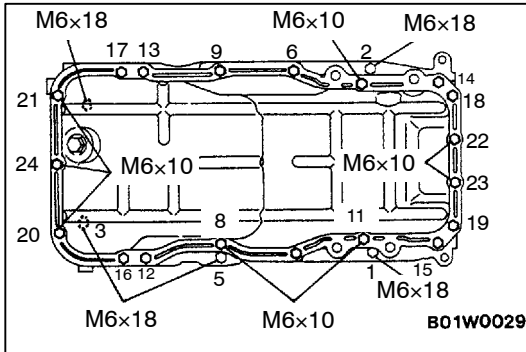
REMOVAL SERVICE POINT

◀A▶ OIL PAN LOWER REMOVAL

1. Remove the oil pan, lower installation bolt.
2. Place a wooden block to the oil pan, lower as shown in the figure and remove by tapping with a hammer.

Caution

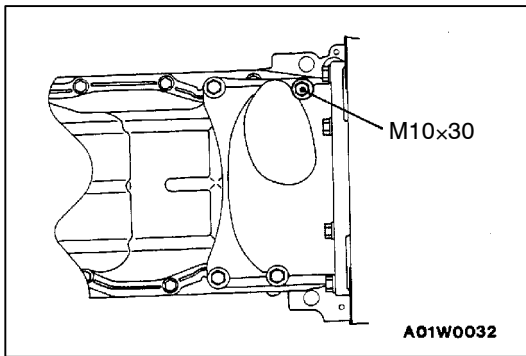
The use of an oil pan remover (MD998727) can damage the oil pan, upper (aluminum made).



INSTALLATION SERVICE POINTS

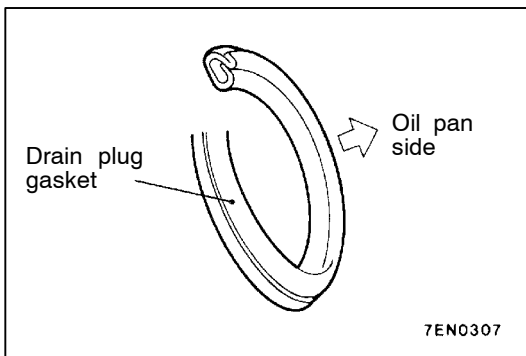
▶A▶ OIL PAN LOWER INSTALLATION

1. Tighten the bolts in order of the numbers shown in the illustration.
2. Be careful when installing, as there are two different lengths of bolt.



▶B▶ TRANSMISSION STAY INSTALLATION

Be careful when installing, as the bolts indicated in the illustration have different lengths from the other bolts.



▶C▶ DRAIN PLUG GASKET INSTALLATION

Replace the gasket with a new gasket. Install the new gasket in the direction shown in the illustration.

INSPECTION

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

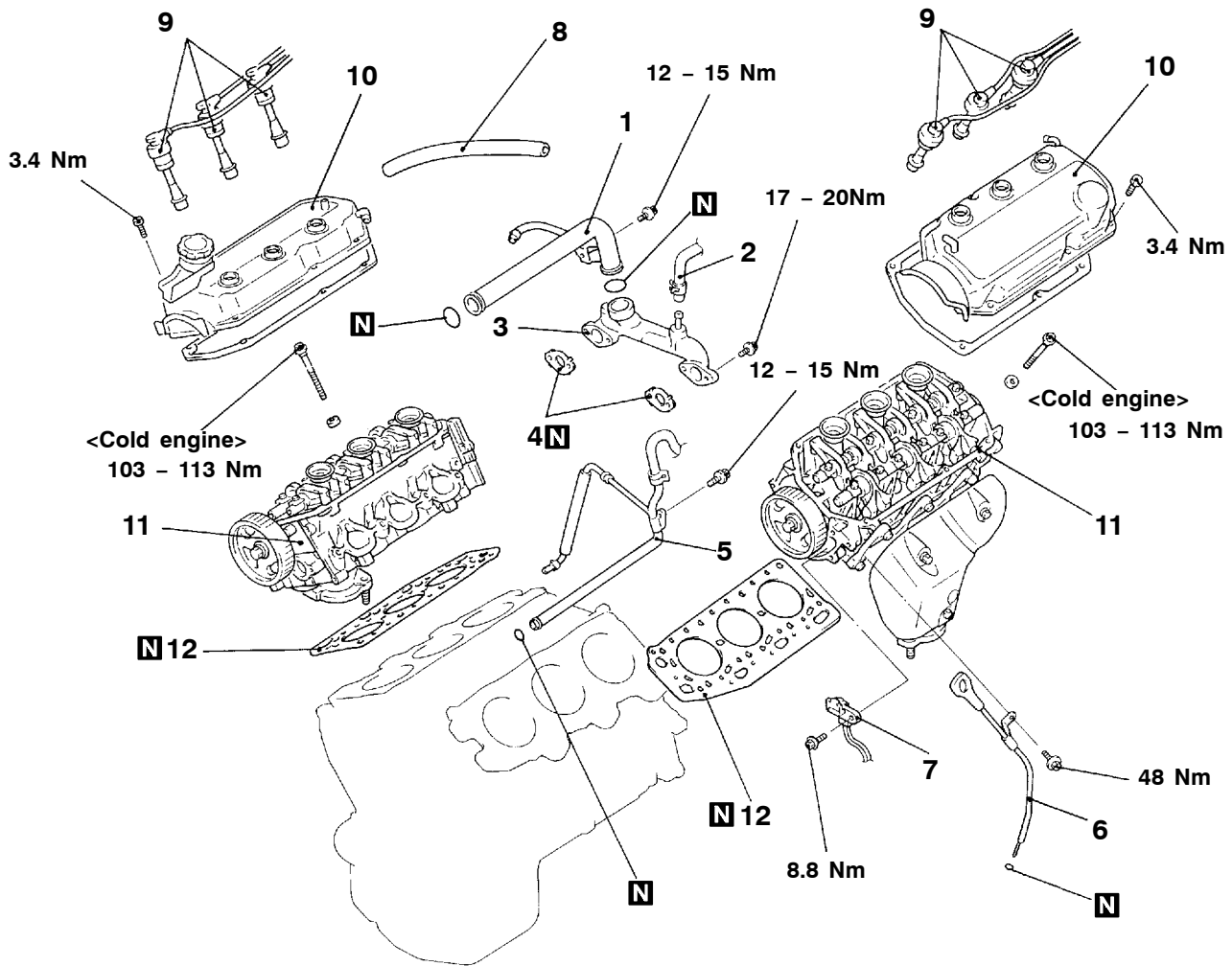
CYLINDER HEAD GASKET

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REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

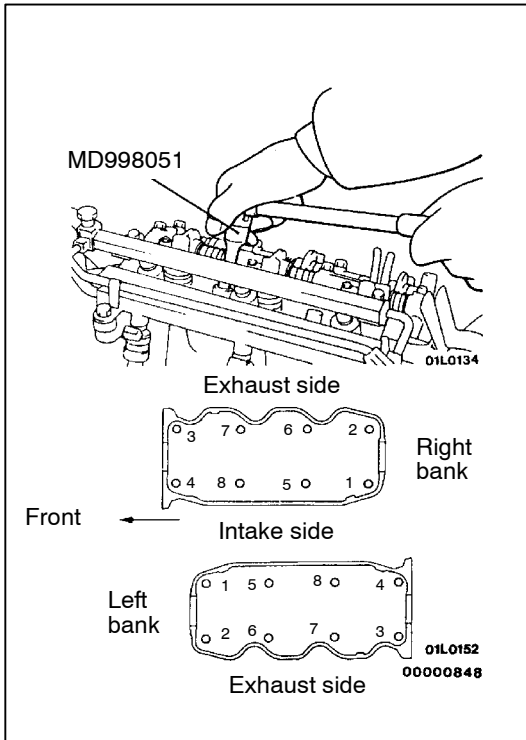
- Intake Manifold Removal and installation (Refer to GROUP 15 – Intake Manifold.)
- Timing Belt Removal and installation (Refer to P.11A-28.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)



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Removal steps

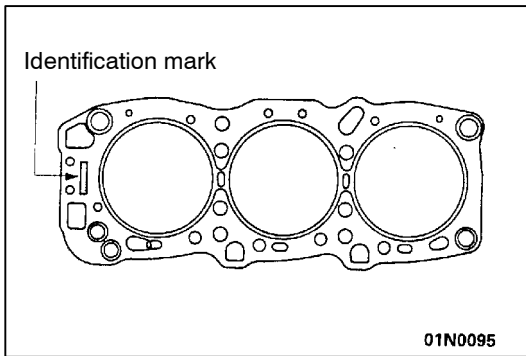
- | | |
|---|--|
| <p>1. Water outlet pipe assembly</p> <p>2. Heater hose connection</p> <p>3. Water passage assembly</p> <p>4. Gasket</p> <p>5. Water pipe and hose assembly</p> <p>6. Oil dipstick assembly <when removing left bank only></p> | <p>7. Camshaft position sensor <when removing left bank only></p> <p>8. Breather hose</p> <p>9. Spark plug cable</p> <p>10. Rocker cover</p> <p>11. Cylinder head assembly</p> <p>12. Cylinder head gasket</p> |
|---|--|



REMOVAL SERVICE POINTS

◀A▶ CYLINDER HEAD ASSEMBLY REMOVAL

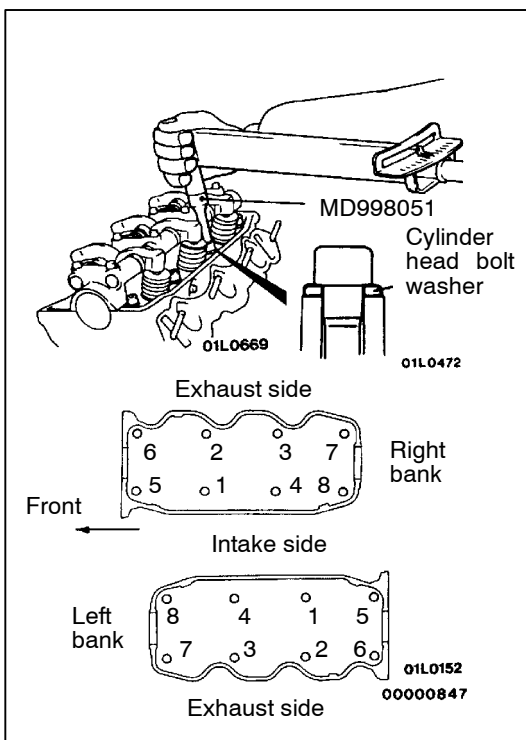
Use special tool to tighten each bolt two or three steps in the order shown in the illustration.



II INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

1. Degrease the cylinder head and cylinder block gasket mounting surfaces.
2. Make sure that the gasket has the proper identification mark for the engine.
3. Lay the cylinder head gasket on the cylinder block with the identification mark at the front top.



▶B◀ CYLINDER HEAD ASSEMBLY INSTALLATION

1. Use a scraper to clean the gasket surface of the cylinder head assembly.

Caution

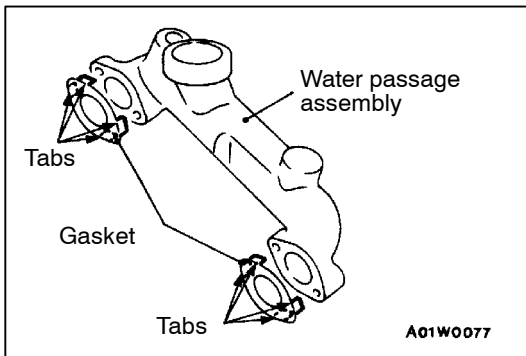
Be careful that no foreign material gets into the cylinder, coolant passages or oil passages. Engine damage may result.

2. Using special tool and a torque wrench, tighten the bolts to the specified torque in the order shown in the illustration. (in two or three cycles)

Tightening torque: 103 – 113 Nm

Caution

Install the head bolt washers with the beveled side facing upwards as shown in the illustration.



►C◄ GASKET/WATER PASSAGE ASSEMBLY INSTALLATION

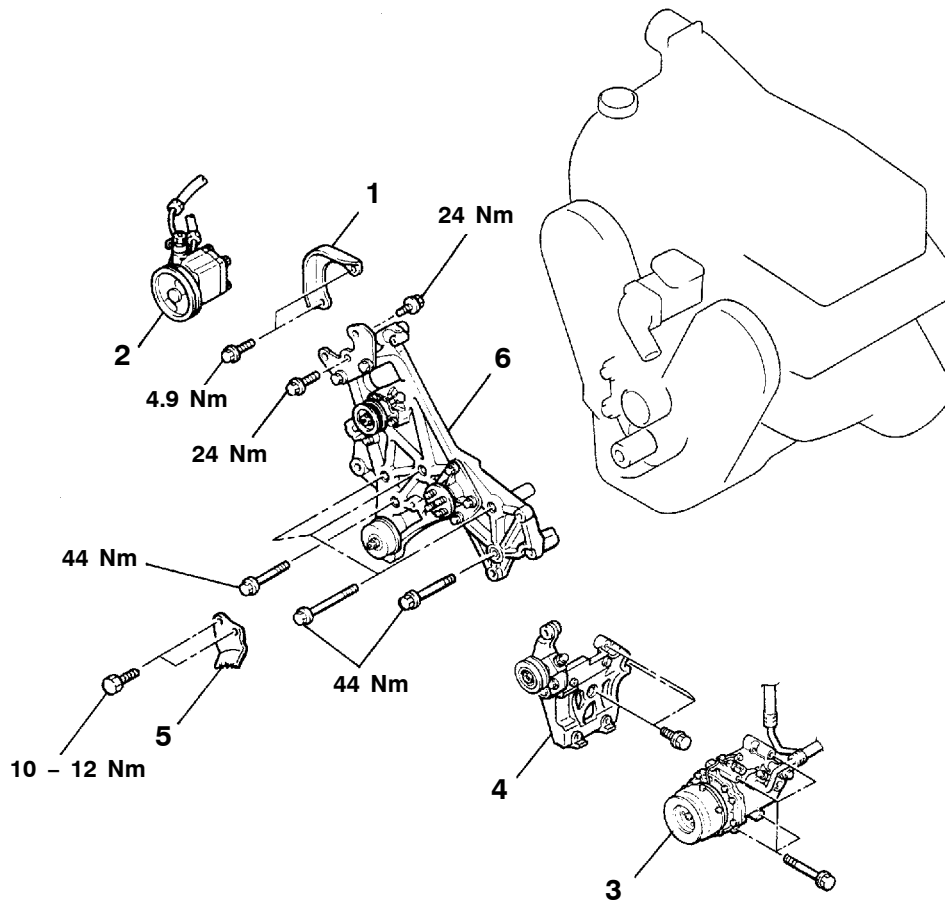
Bend the tabs onto the water passage assembly. Then install the water passage assembly to the cylinder head so that the gasket doesn't slip.

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal Operation

- Engine Coolant Draining and Refilling (Refer to GROUP 14 – On-vehicle Service.)
- Cooling Fan Removal (Refer to GROUP 14 – Cooling Fan.)
- Alternator Removal and Installation (Refer to GROUP 16 – Alternator.)

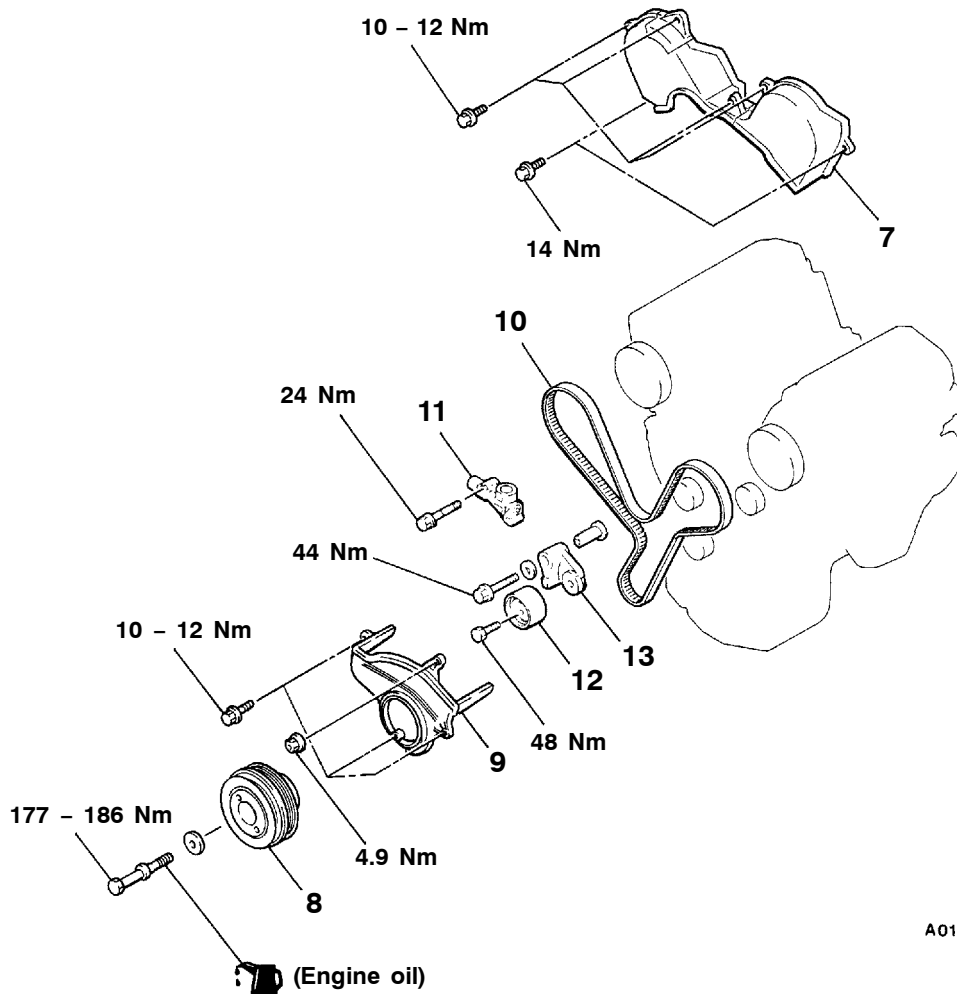


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Removal steps

1. Cover
2. Power steering oil pump assembly
3. A/C compressor assembly
4. Compressor bracket
5. Timing indicator bracket
6. Accessory mount assembly





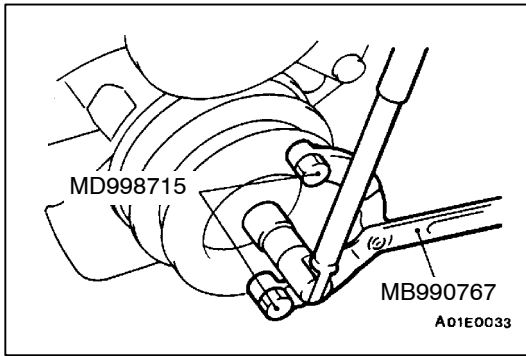
A01V0113

- ◀B▶ ▶C▶ 7. Timing belt upper cover assembly
- ◀C▶ ▶B▶ ▶A▶ 8. Crankshaft pulley
- ▶C▶ ▶B▶ ▶A▶ 9. Timing belt lower cover assembly
- ▶C▶ ▶B▶ ▶A▶ 10. Timing belt
- ▶C▶ ▶B▶ ▶A▶ 11. Auto-tensioner
- ▶C▶ ▶B▶ ▶A▶ 12. Tension pulley
- ▶C▶ ▶B▶ ▶A▶ 13. Tensioner arm assembly

REMOVAL SERVICE POINTS

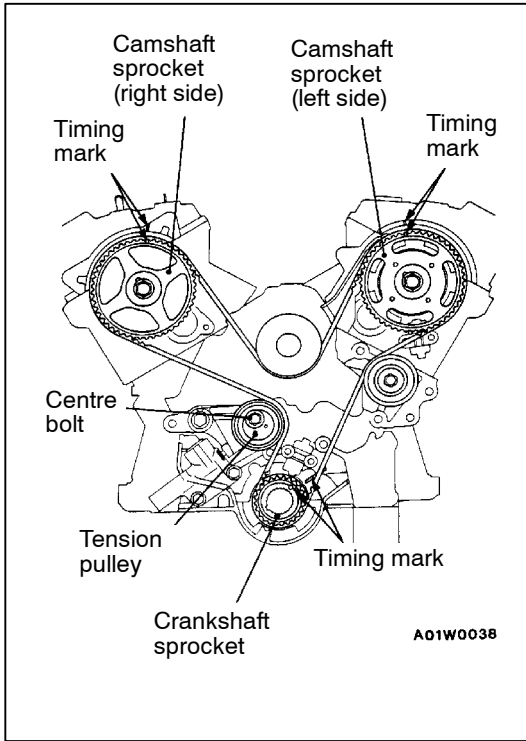
◀A▶ POWER STEERING OIL PUMP ASSEMBLY / A/C COMPRESSOR ASSEMBLY REMOVAL

1. Do not disconnect the hoses to remove the pump and compressor.
2. Support the removed pump and compressor with a wire, etc. so that they will not get in the way while working.



◀B▶ CRANKSHAFT PULLEY REMOVAL

Use special tools to remove the crankshaft pulley from the crankshaft.



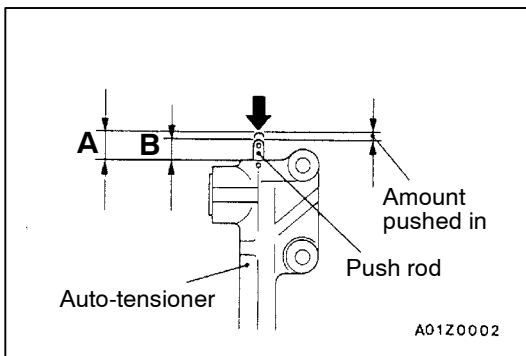
◀C▶ TIMING BELT REMOVAL

1. Turn the crankshaft clockwise to align each timing mark and to set the No. 1 cylinder to compression top dead centre.

Caution

Never turn the crankshaft counterclockwise.

2. If the timing belt is to be reused, chalk mark the flat side of the belt with an arrow indicating the clockwise direction.
3. Loosen the centre bolt of the tension pulley, and then remove the timing belt.



INSTALLATION SERVICE POINTS

▶A◀ AUTO-TENSIONER INSTALLATION

1. While holding the auto-tensioner by hand, press the end of the push rod against a metal surface (such as the cylinder block) with a force of 98 – 196 Nm and measure how far the push rod is pushed in.

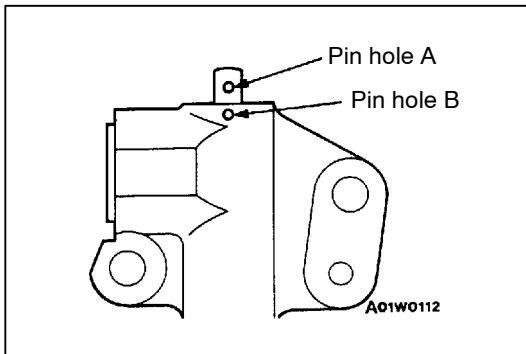
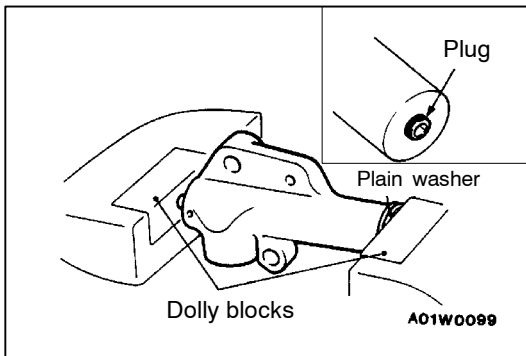
Standard value: Within 1 mm

A: Length when no force is applied

B: Length when force is applied

A – B: Amount pushed in

2. If it is not within the standard value, replace the auto-tensioner.



- Place two dolly blocks in a vice as shown in the illustration, and then place the auto-tensioner in the vice.

Caution

- Place the auto-tensioner perpendicular to the jaws of the vice.
- If there is a plug at the base of the aut-tensioner, insert a plain washer onto the end of the auto-tensioner to protect the plug.

- Slowly compress the push rod of the auto-tensioner until pin hole A in the push rod is aligned with pin hole B in the cylinder.

Caution

Never compress the push rod too fast, or the push rod may be damaged.

- Insert the setting pin into the pin holes once they are aligned.

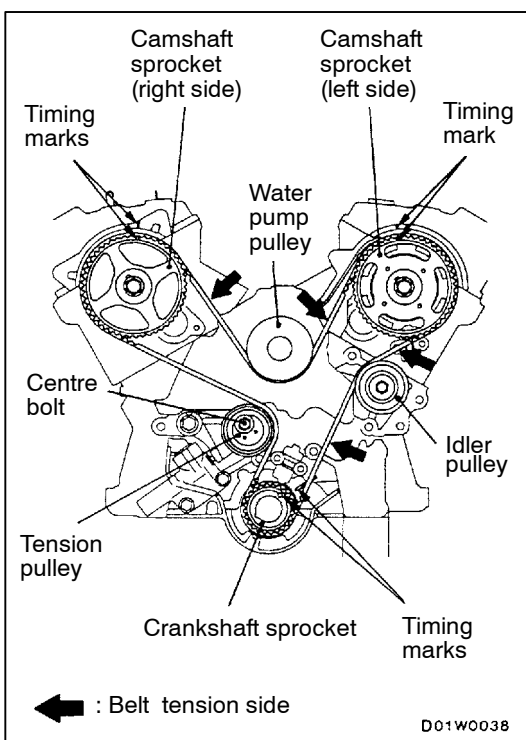
NOTE

If replacing the auto-tensioner, the pin will already be inserted into the pin holes of the new part.

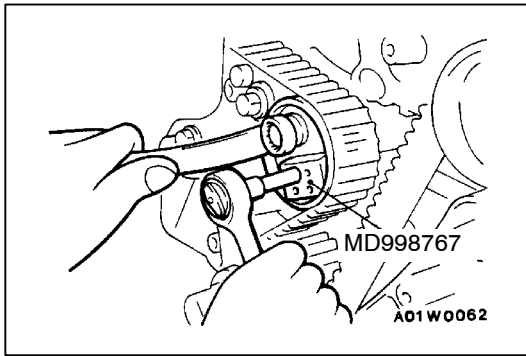
- Install the auto-tensioner to the engine.

Caution

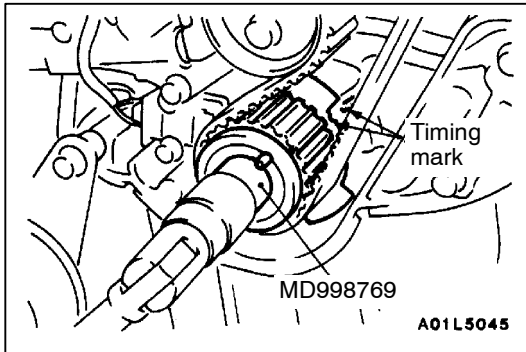
Do not remove the setting pin from the auto-tensioner.

**►B◀ TIMING BELT INSTALLATION**

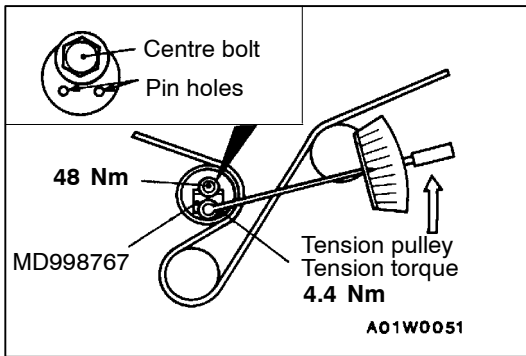
- Align the timing marks of the camshaft sprocket with those of crankshaft sprocket.
 - Install the timing belt by the following procedure so that there is no deflection in the timing belt between each sprocket and pulley.
 - Crankshaft sprocket
 - Idler pulley
 - Camshaft sprocket (Left side)
 - Water pump pulley
 - Camshaft sprocket (Right side)
 - Tension pulley
- Caution**
The camshaft sprocket (right side) can turn easily due to the spring force applied, so be careful not to get your fingers caught.
- Turn the camshaft sprocket counterclockwise until the tension side of the timing belt is firmly stretched. Check all timing marks again.



4. Use special tool to push the tensioner pulley into the timing belt, and then temporarily tighten the centre bolt.



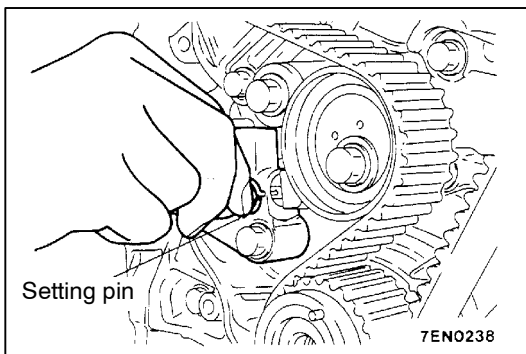
5. Use special tool to turn the crankshaft 1/4 turn counterclockwise and then turn it again clockwise until the timing marks are aligned.



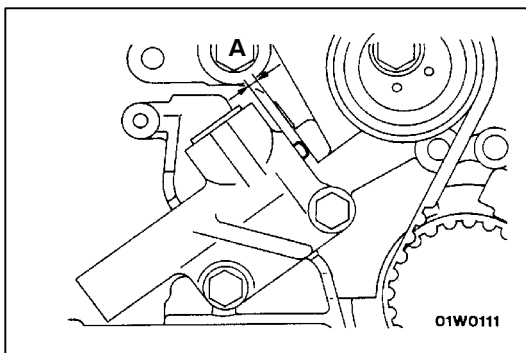
6. Loosen the centre bolt of the tensioner pulley. Use special tool and a torque wrench to apply the standard torque to the timing belt as shown in the illustration. Then tighten the centre bolt to the specified torque.

Standard value: 4.4 Nm
 <Timing belt tension torque>

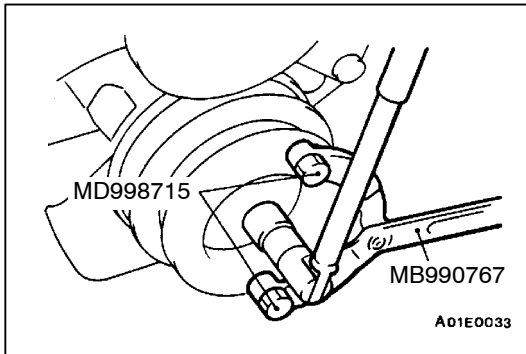
Caution
 When tightening the centre bolt, be careful that the tensioner pulley does not turn with the bolt.



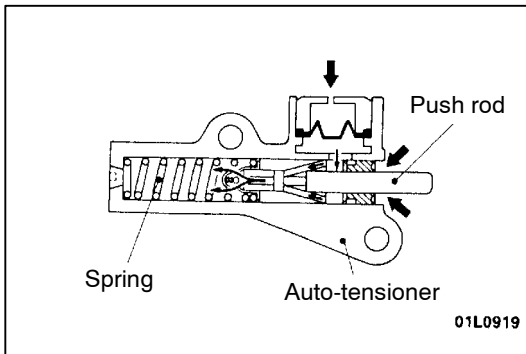
7. Remove the setting pin that has been inserted into the auto-tensioner.
8. Turn the crankshaft two turns clockwise to align the timing marks.



9. Wait for at least five minutes, and then check that the auto-tensioner pushrod extends within the standard value.
Standard value (A): 3.8 – 5.0 mm
10. If no, repeat the operation in steps (5) to (9) above.
11. Check again that the timing marks of each sprocket are aligned.

**▶◀ CRANKSHAFT PULLEY INSTALLATION**

Use special tools to install the crankshaft pulley.

**INSPECTION**

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AUTO-TENSIONER

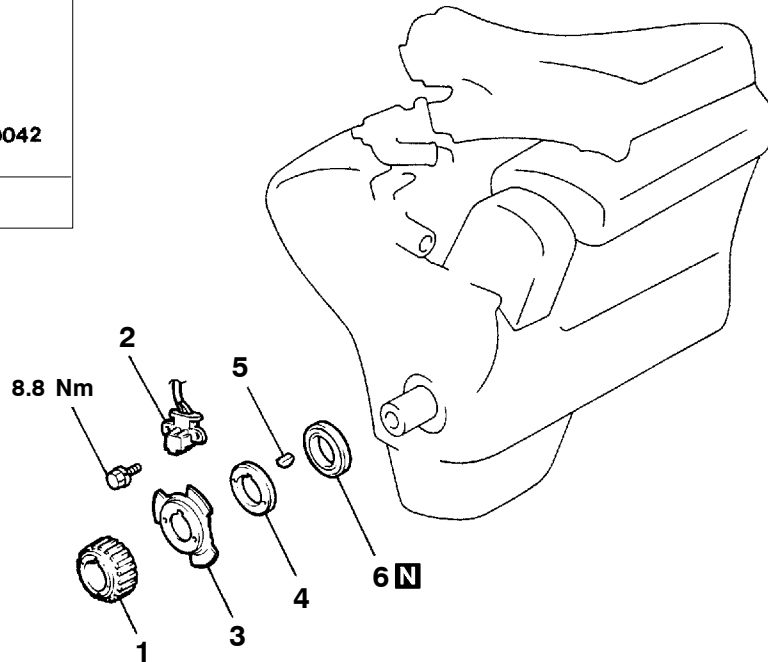
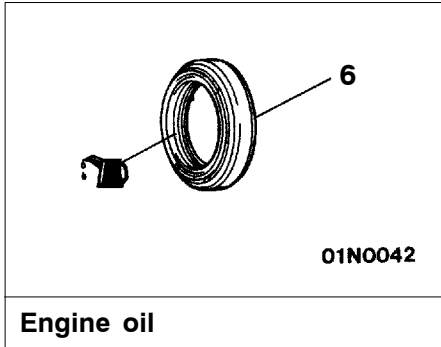
- Check the auto-tensioner for possible leaks.
- Check the push rod for cracks.

CRANKSHAFT FRONT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

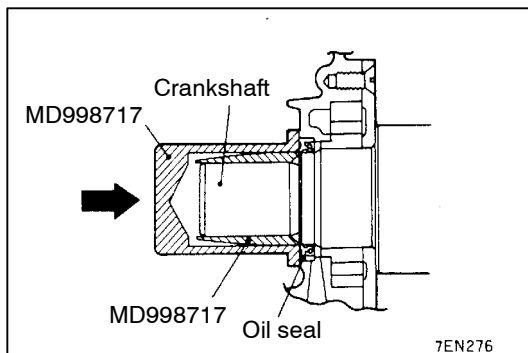
- Timing Belt Removal and Installation (Refer to P.11A-28.)



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Removal steps

1. Crankshaft sprocket
2. Crankshaft angle sensor
3. Crankshaft sensing blade
4. Crankshaft spacer
5. Key
6. Crankshaft front oil seal



INSTALLATION SERVICE POINT

▶◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

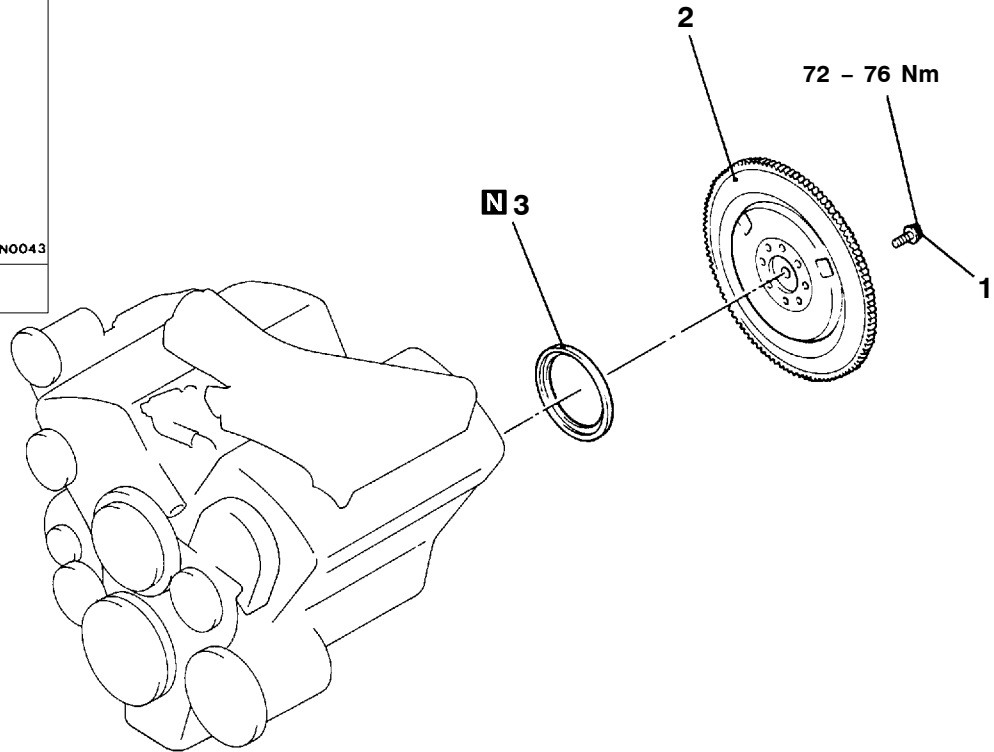
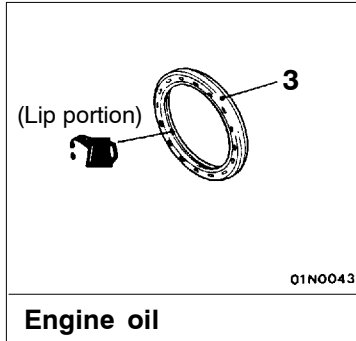
1. Apply a small amount of engine oil to the oil seal lip and then insert.
2. Using special tool, tap the oil seal into the front case.

CRANKSHAFT REAR OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Transmission and Transfer Assembly Removal and Installation (Refer to GROUP 22 – Transmission Assembly.)

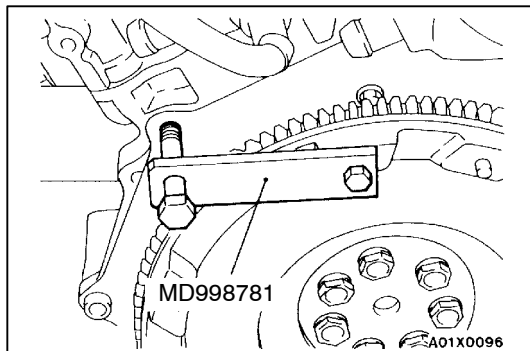


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Removal steps

- Clutch cover and clutch disc
- ◀A▶ ▶B▶ 1. Flywheel bolt

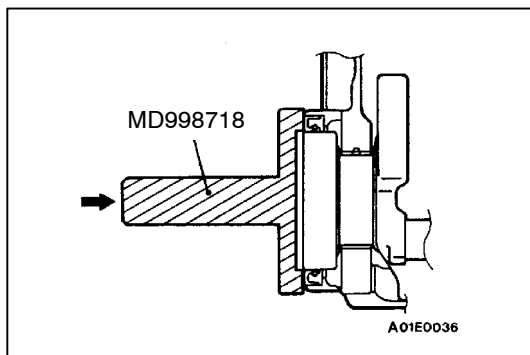
- ▶A▶ 2. Flywheel
3. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ FLYWHEEL BOLT REMOVAL

Use special tool to secure the flywheel and remove the flywheel bolt.



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

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

▶B◀ FLYWHEEL BOLT INSTALLATION

Use special tool in the same way as during removal to install the flywheel bolt.

ENGINE ASSEMBLY

11200100992

REMOVAL AND INSTALLATION

Caution

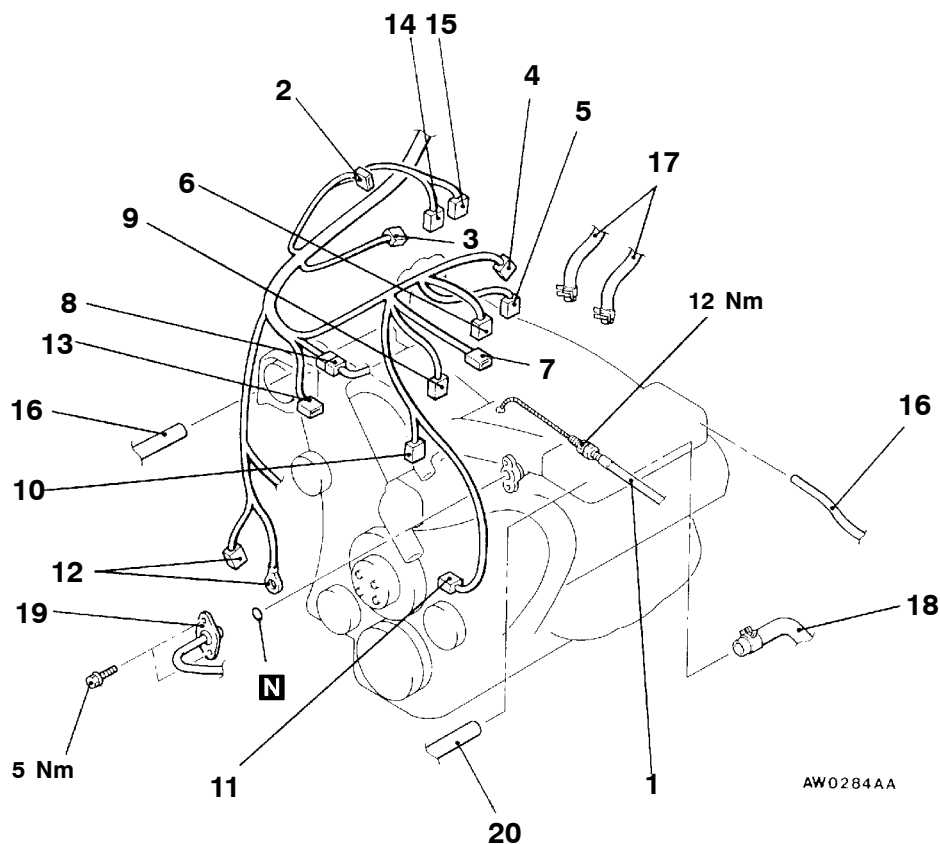
*: Indicates parts which should be initially tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

Pre-removal Operation

- Hood Removal (Refer to GROUP 42 – Hood.)
- Fuel Line Pressure Releasing (Refer to GROUP 13A – On-vehicle Service.)
- Air Cleaner and Air Intake Hose Removal (Refer to GROUP 15 – Air Cleaner.)
- Battery Removal
- Radiator Removal (Refer to GROUP 14 – Radiator.)
- Front Exhaust Pipe Removal (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)
- Transmission Assembly Removal (Refer to GROUP 22 – Transmission Assembly.)

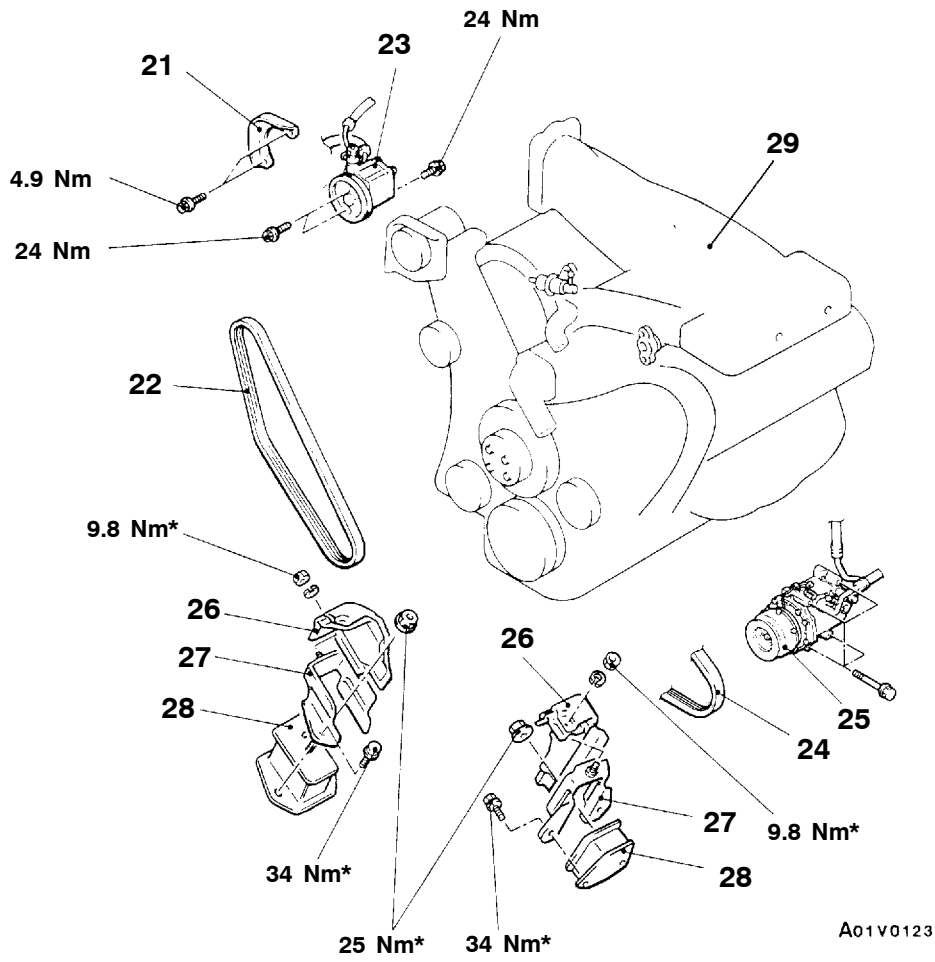
Post-installation Operation

- Transmission Assembly Installation (Refer to GROUP 22 – Transmission Assembly.)
- Front Exhaust Pipe Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)
- Radiator Installation (Refer to GROUP 14 – Radiator.)
- Battery installation
- Air Cleaner and Air Intake Hose Installation (Refer to GROUP 15 – Air Cleaner.)
- Hood Installation (Refer to GROUP 42 – Hood.)
- Drive Belt Tension Adjustment (Refer to P.11A-8.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



Removal steps

- | | |
|--|--|
| 1. Accelerator cable connection | 11. Oil pressure switch connector |
| 2. Throttle position sensor connector | 12. Alternator connector |
| 3. Idle speed control servo connector | 13. Ignition coil connector |
| 4. Power transistor connector | 14. EGR solenoid valve |
| 5. Camshaft position sensor connector | 15. Purge control solenoid valve |
| 6. Crank angle sensor connector | 16. Vacuum hose connection |
| 7. Capacitor connector | 17. Heater hose connection |
| 8. Injector harness connector | 18. Fuel return hose connection |
| 9. Engine coolant temperature gauge unit connector | 19. High-pressure fuel hose connection |
| 10. Engine coolant temperature sensor connector | 20. PCV hose connection |



- 21. Power steering drive belt cover
- 22. Drive belt (for power steering)
- 23. Power steering oil pump assembly
- 24. Drive belt (for A/C)



- 25. A/C compressor assembly
- 26. Heat protector
- 27. Front insulator stopper



- 28. Front engine support insulator
- 29. Engine assembly

REMOVAL SERVICE POINTS**◀A▶ POWER STEERING OIL PUMP ASSEMBLY AND A/C COMPRESSOR ASSEMBLY REMOVAL**

1. Remove the oil pump and A/C compressor (with the hose attached).
2. Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

◀B▶ ENGINE ASSEMBLY REMOVAL

1. Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
2. Lift the special tool (MB991683) and chain block slowly to remove the engine assembly upward from the engine compartment.

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

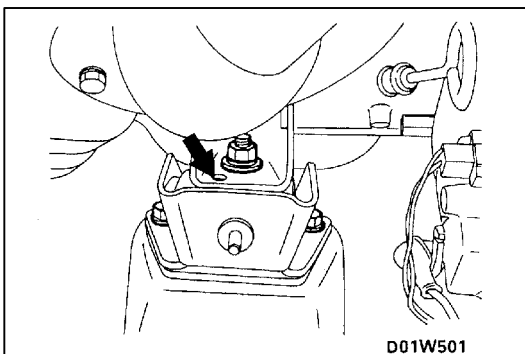
Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.

▶B◀ FRONT ENGINE SUPPORT INSULATOR INSTALLATION

Make sure that the locating boss and hole are in alignment.

Caution

Do not distort rubber portions, and never stain rubber portions with fuel or oil.



NOTES

ENGINE <4D5>

CONTENTS

11109000825

GENERAL INFORMATION	2	Timing Belt Tension Adjustment	14
SERVICE SPECIFICATIONS	3	Timing Belt B Tension Adjustment	15
SEALANTS	3	CRANKSHAFT PULLEY	17
SPECIAL TOOLS	4	CAMSHAFT AND CAMSHAFT OIL SEAL ..	18
ON-VEHICLE SERVICE	5	OIL PAN AND OIL SCREEN	21
Drive Belt Tension Check and Adjustment	5	CYLINDER HEAD GASKET	23
Valve Clearance Check and Adjustment	8	TIMING BELT AND TIMING BELT B	26
Injection Timing Check and Adjustment	9	CRANKSHAFT FRONT OIL SEAL	30
Idle Speed Check and Adjustment	12	CRANKSHAFT REAR OIL SEAL	31
Idle-up Mechanism Check and Adjustment-For A/C	12	ENGINE ASSEMBLY	33
Compression Pressure Check	13		

GENERAL INFORMATION

11100010339

Items	4D56	
Total displacement mL	2,477	
Bore x Stroke mm	91.1 x 95.0	
Compression ratio	21	
Combustion chamber	Vortex chamber type	
Camshaft arrangement	SOHC	
Number of valve	Intake	4
	Exhaust	4
Valve timing	Intake	Opening BTDC 20°, Closing ABDC 49°
	Exhaust	Opening BBDC 55°, Closing ATDC 22°
Fuel system	Distribution type injection pump	
Rocker arm	Roller type	
Adjusting screw	Elephant foot type	

SERVICE SPECIFICATIONS

11100030670

Items			Standard value	Limit
Alternator drive belt tension (for each belt)	Tension N	When checked	245 – 441	–
		When a used belt is installed	294 – 392	–
		When a new belt is installed	392 – 588	–
	Deflection (Reference value) mm	When checked	12.0 – 17.0	–
		When a used belt is installed	13.0 – 16.0	–
		When a new belt is installed	10.0 – 13.0	–
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 (Reference value) mm	When checked	8.0 – 12.0	–
		When a used belt is installed	9.0 – 11.5	–
		When a new belt is installed	6.0 – 8.0	–
A/C compressor drive belt tension	Tension N	When checked	343 – 441	–
		When a used belt is installed	343 – 441	–
		When a new belt is installed	490 – 558	–
	Deflection (Reference value) mm	When checked	6.5 – 7.5	–
		When a used belt is installed	6.5 – 7.5	–
		When a new belt is installed	5.2 – 6.0	–
Valve clearance (at hot) mm			0.25	–
Injection timing (Value indicated on dial gauge mm)			9° ATDC (1 ± 0.03)	–
Idle speed r/min			750 ± 100	–
Compression pressure kPa			3,040	Min. 2,200
Compression pressure difference of all cylinder (at engine speed of 280 r/min) kPa			–	Max. 300
Timing belt tension mm			4 – 5	–
Timing belt B tension mm			4 – 5	–

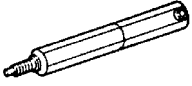

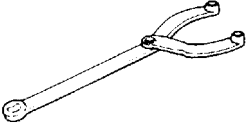
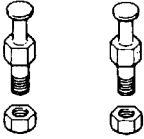

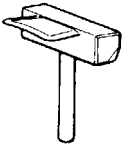
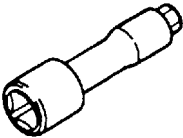
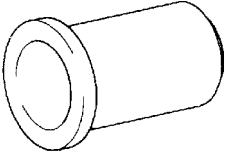
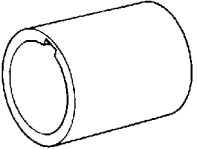
SEALANTS

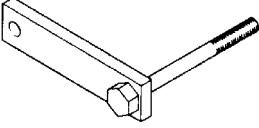
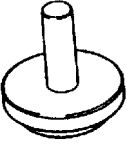
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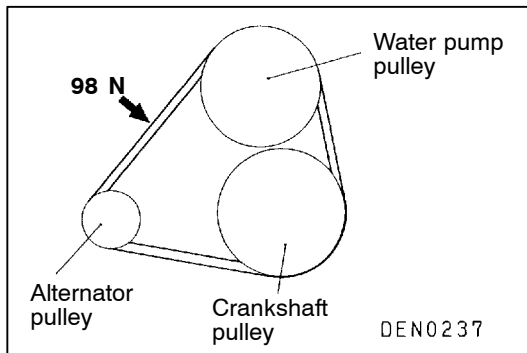
Items	Specified sealant	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Semi-circular packing and rocker cover seal, and cylinder head seal	3M ATD Part No. 8660 or equivalent	

SPECIAL TOOLS

11100060327

Tool	Number	Name	Use
	MD998384	Prestroke measuring adapter	Adjustment of the injection timing
	MD998721	Crankshaft pulley holder	Holding the crankshaft pulley
	MB990767	End yoke holder	Holding the camshaft sprocket
	MD998719	Crankshaft pulley holder pin	
	MD998381	Camshaft oil seal installer	Installing the camshaft oil seal
	MD998727	Oil pan remover	Removal of oil pan
	MD998051	Cylinder head bolt wrench	Removal and installation of the cylinder head bolt
	MD998382	Crankshaft front oil seal installer	Installing the crankshaft front oil seal
	MD998383	Crankshaft front oil seal guide	

Tool	Number	Name	Use
	MD998781	Flywheel stopper	Securing the flywheel
	MD998376	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal



ON-VEHICLE SERVICE

11100090333

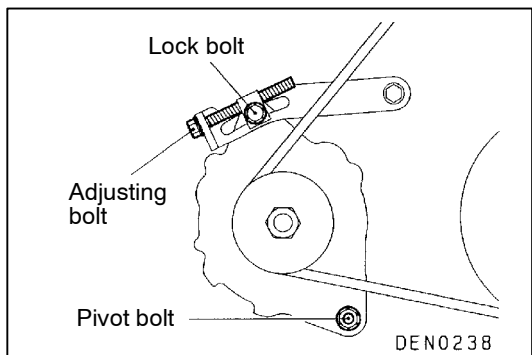
DRIVE BELT TENSION CHECK AND ADJUSTMENT

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 (for each belt):

Tension N	245 – 441
Deflection (Reference value) mm	12.0 – 17.0



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 (for each belt):

Items	When a used belt is installed	When a new belt is installed
Tension N	294 – 392	392 – 588
Deflection (Reference value) mm	13.0 – 16.0	10.0 – 13.0

4. Tighten the nut of the alternator pivot bolt.

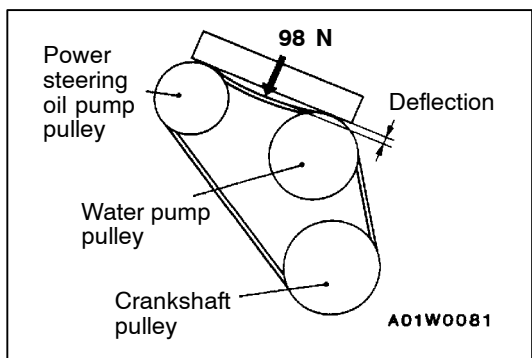
Tightening torque: 44 Nm

5. Tighten the lock bolt.

Tightening torque: 22 Nm

6. Tighten the adjusting bolt.

Tightening torque: 5 Nm



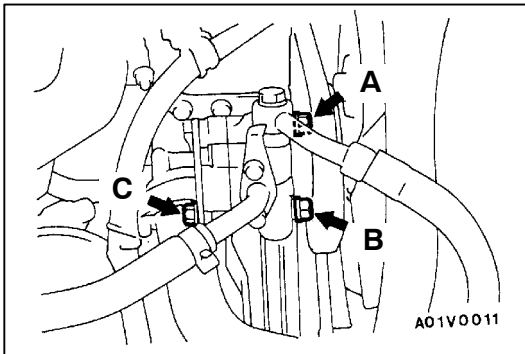
POWER STEERING OIL PUMP DRIVE BELT TENSION CHECK AND ADJUSTMENT

11100110152

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	294 – 490	343 – 441	490 – 686
Deflection (Reference value) mm	8.0 – 12.0	9.0 – 11.5	6.0 – 8.0



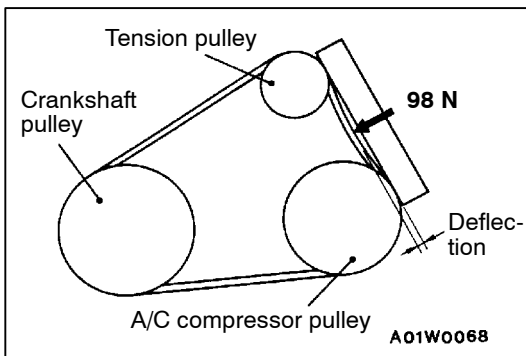
2. If the tension or deflection is outside the standard value, adjust by the following procedure.
 - (1) Loosen power steering oil pump fixing bolts A, B and C.
 - (2) Adjust the amount of belt deflection using adjusting bolt D.
 - (3) Tighten fixing bolts A, B and C.

Tightening torque: 22 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).



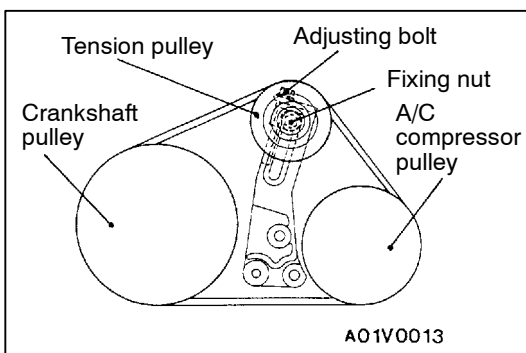
AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

11100100258

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 intalled	When a new belt is installed
Tension N	343 – 441	343 – 441	490 – 588
Deflection (Reference value) mm	6.5 – 7.5	6.5 – 7.5	5.2 – 6.0



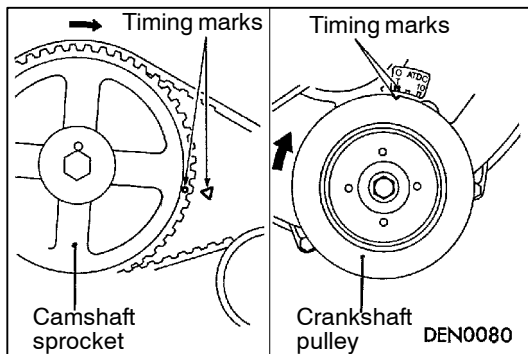
2. If the tension or deflection is outside the standard value, adjust by the following procedure.

- (1) Loosen tension pulley fixing nut.
- (2) Adjust belt tension with adjusting bolt.
- (3) Tighten fixing nut.

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

Caution

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

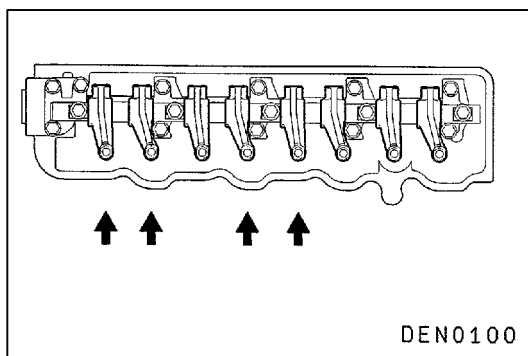
**VALVE CLEARANCE CHECK AND ADJUSTMENT**

11100150109

1. Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 90 °C.
2. Remove the timing belt upper cover.
3. Remove the rocker cover.
4. Align the camshaft sprocket timing marks and set the No. 1 cylinder at top dead centre.

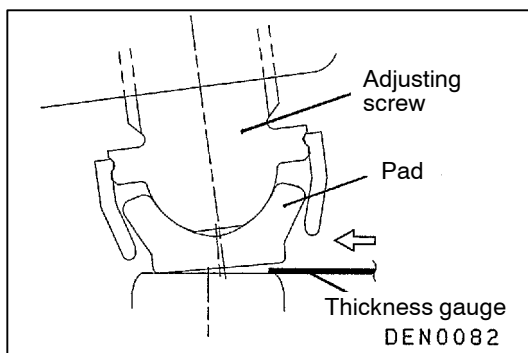
Caution

The crankshaft should always be turned in a clockwise direction.

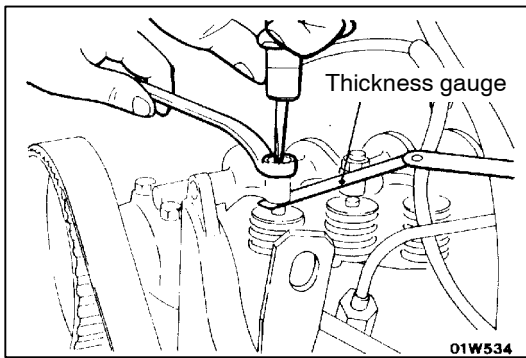


5. Measure the valve clearance at the places indicated by arrows in the illustration.

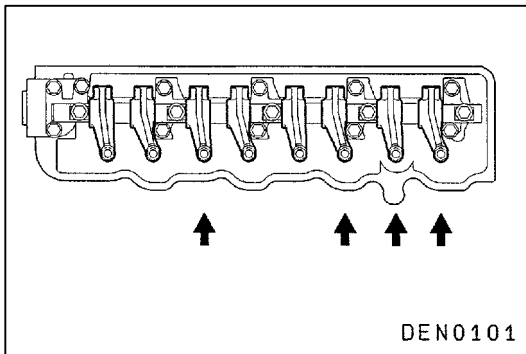
Standard value: 0.25 mm

**NOTE**

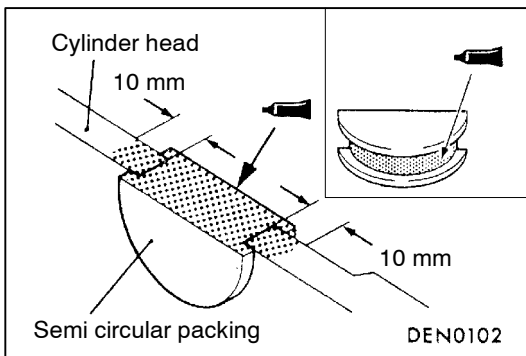
Insert the thickness gauge from the centre of the cylinder head towards the outside so that it doesn't touch the pad.



6. If the clearance is outside the standard value, loosen the lock nut of the rocker arm and adjust by turning the adjusting screw while using a thickness gauge to measure the clearance.
7. Tighten the lock nut while holding the adjusting screw with a screwdriver so that it doesn't turn.
8. Turn the crankshaft 360° clockwise to bring No. 4 cylinder to the top dead centre position.



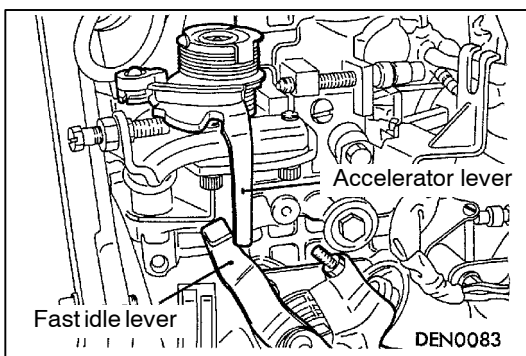
9. Measure the valve clearances at the places indicated by arrows in the illustration. If the clearance is not within the standard value, repeat steps 7 and 8 above.



10. Apply specified sealant to the section of the semi-circular packing shown in the illustration.

Specified sealant: 3M ATD Part No. 8660 or equivalent

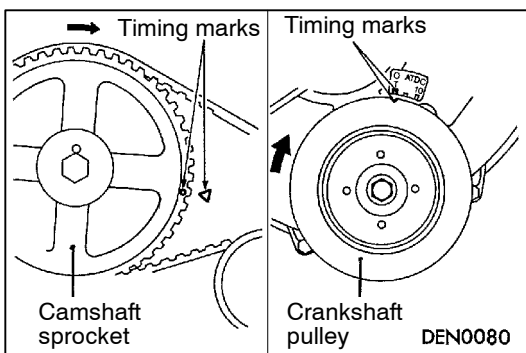
11. Install the rocker cover.
12. Install the timing belt upper cover.



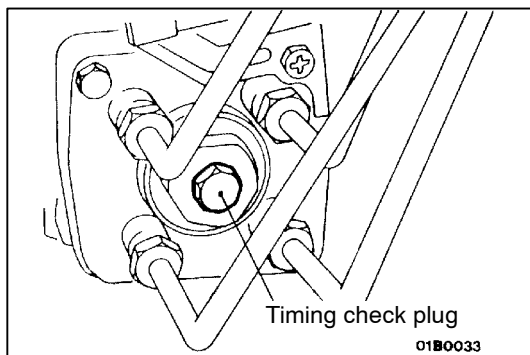
INJECTION TIMING CHECK AND ADJUSTMENT

11100180085

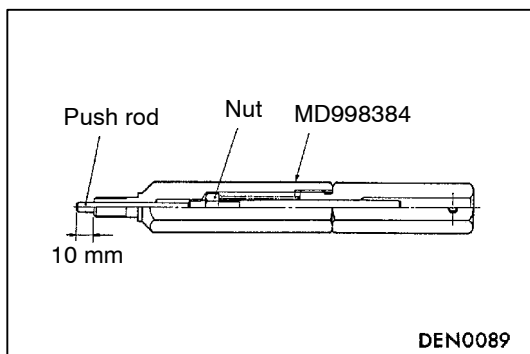
1. Warm up the engine and then check to be sure that the fast idle lever is separated from the accelerator lever.
2. Remove all of the glow plugs.
3. Remove the timing belt upper cover.



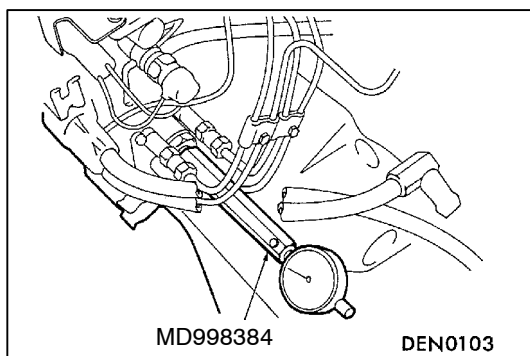
4. Align the timing marks of the camshaft sprocket and set the No. 1 cylinder to the top dead centre position.



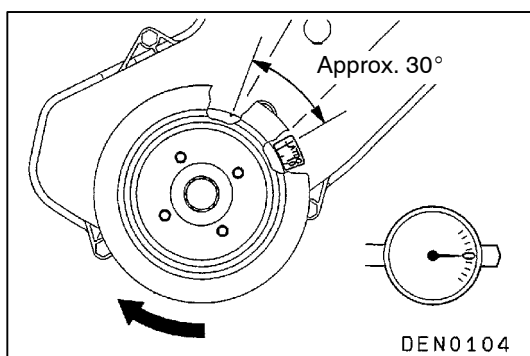
- Remove the timing check plug at the rear of the injection pump.



- Before installation of special tool, make sure that push rod is protruding by 10 mm. Protrusion of push rod can be adjusted with an inner nut.
- Connect the dial gauge to the special tool.



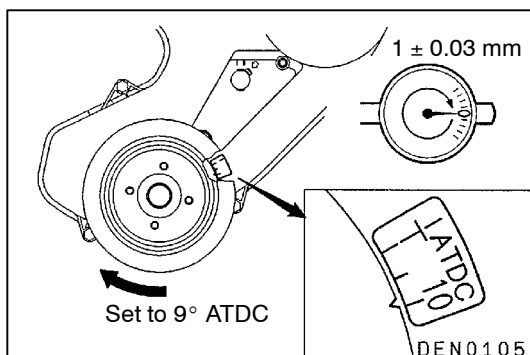
- Install the special tool to the check plug at the rear of the injection pump.



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

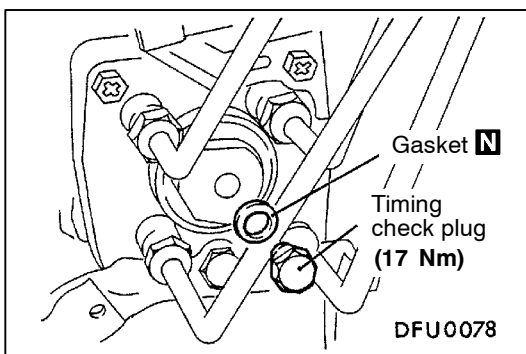
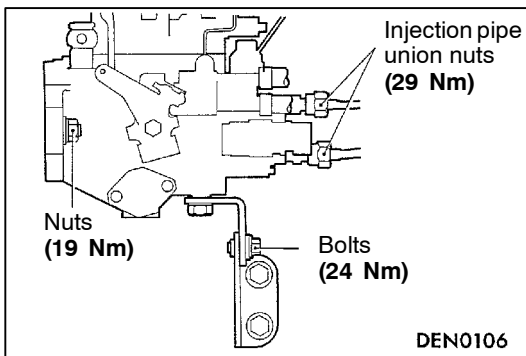
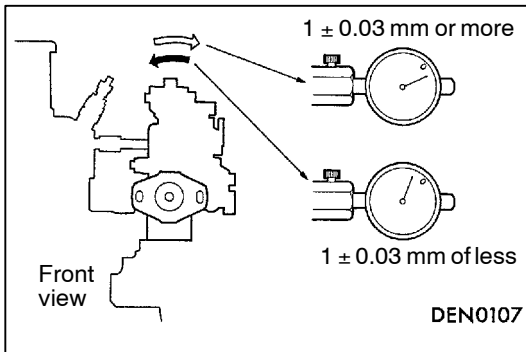
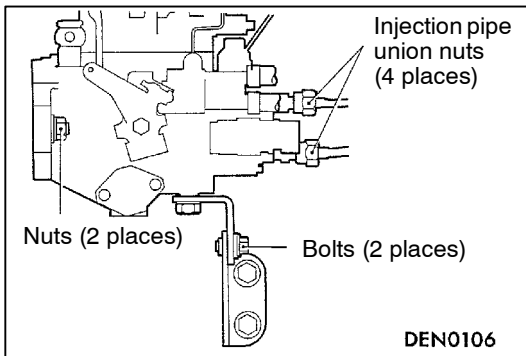
NOTE

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.



- Turn the crankshaft clockwise to align the No. 1 cylinder to 9° ATDC.
- Check that the value indicated on the dial gauge is at the standard value.

Standard value: 1 ± 0.03 mm



14. If the needle 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 and right and adjust the needle on the dial gauge so that the display value is uniform.
- (4) Provisionally tighten the mounting nut and bolt of the injection pump.
- (5) Repeat steps 9 – 13 to check if the adjustment has been made correctly.

- (6) Tighten the mounting nuts and bolts to the specified torque.

- (7) Tighten the injection pump union nuts to the specified torque.

Caution

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

15. Remove the special tool.

16. Install a new gasket to the timing check plug.

17. Tighten the timing check plug to the specified torque.

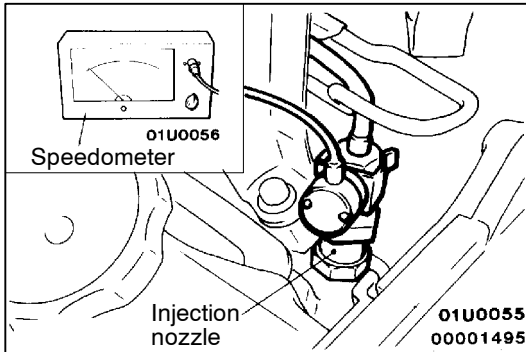
IDLE SPEED CHECK AND ADJUSTMENT

11100190347

NOTE

Check that the injection timing is normal

1. Before inspection, set the vehicle to the pre-inspection condition.



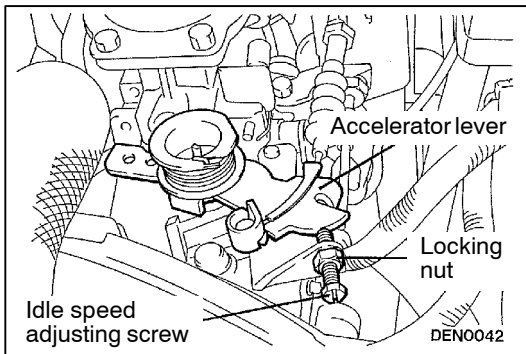
2. Connect the speedometer to the injection nozzle or the injection pipe.

Caution

When the speedometer is connected to the injection pipe, the pipe mounting clamps should all be removed.

3. Start the engine and run it at idle.
4. Check the idle speed.

Standard value: 750 ± 100 r/min



5. If not within the standard value, loosen idle adjusting screw lock nut and adjust the idle speed by rotating adjusting screw. And tighten locking nut.

IDLE-UP MECHANISM CHECK AND ADJUSTMENT-FOR A/C

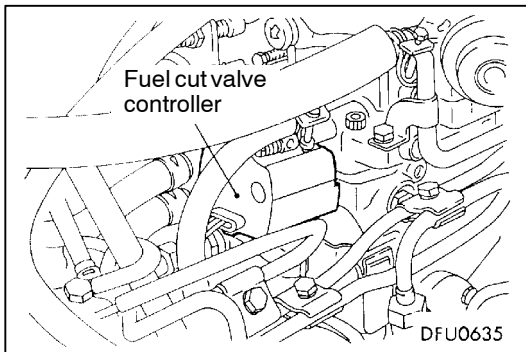
11100230032

Refer to GROUP 55 – On-vehicle Service.

COMPRESSION PRESSURE CHECK

11100260697

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 glow plugs.

Caution**Be careful not to subject the glow plugs to any shocks.**

3. Disconnect the fuel cut valve controller connector.

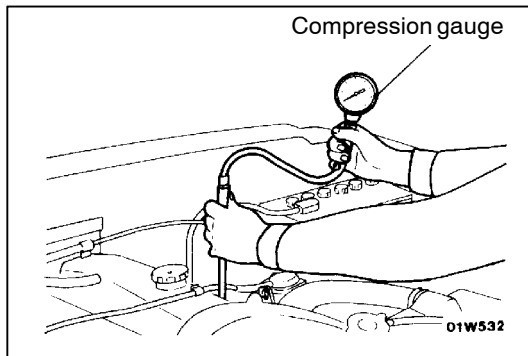
NOTE

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 (at engine speed of 280 r/min):
3,040 kPa**

Limit (at engine speed of 280 r/min): min. 2,200 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 300 kPa

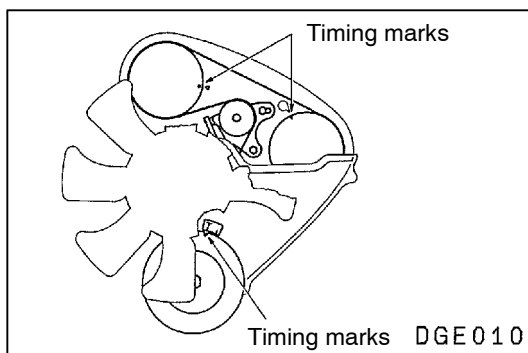
8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the glow plug hole, and repeat the operations in steps (6) and (7).
 - (1) If the compression increases after oil is added, the cause of the malfunction is a worn 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 or fuel cut valve controller connector.
10. Install the glow plugs.

Tightening torque: 18 Nm

TIMING BELT TENSION ADJUSTMENT

11100280136

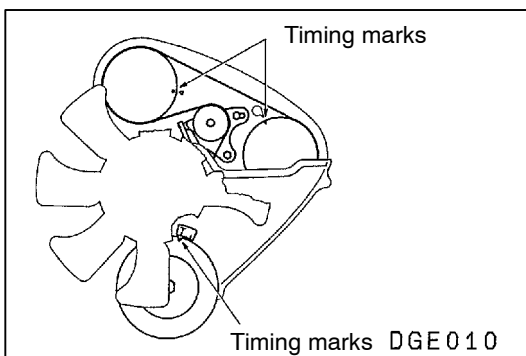
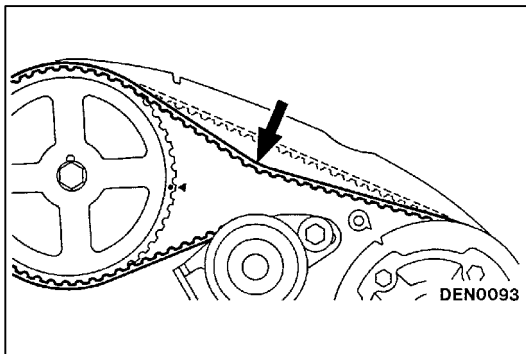
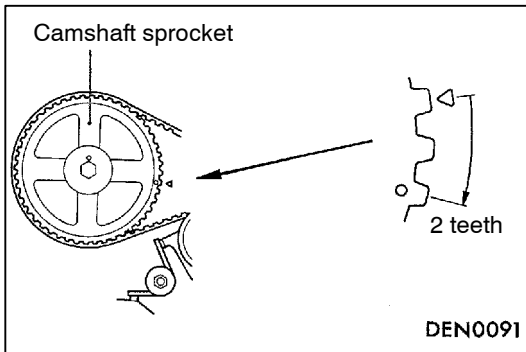
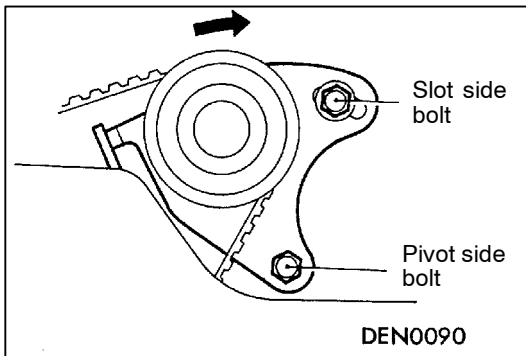
1. Remove timing belt upper cover.
2. Turn the crankshaft in the clockwise direction and check the timing belt around its entire circumference for abnormalities.



3. Align the timing marks on the sprockets with the timing marks on the front upper case.

Caution

When aligning the timing mark, be sure not to turn the crankshaft in the counterclockwise direction as this can cause improper belt tension.



4. Loosen the tensioner pivot side bolt 1 turn and slot side bolt 1 or 2 turns.
5. Turn the crankshaft clockwise and stop at the second lobe of the camshaft sprocket.
6. First tighten tensioner slot side bolt, and then tighten pivot side bolt to the specified torque.

Tightening torque: 25 Nm

7. Turn the crankshaft anti-clockwise to align the timing marks.
8. Push down belt at a point halfway with a forefinger to check that tension of belt is up to standard value.

Standard value: 4 – 5 mm

9. Mount the timing belt upper cover.

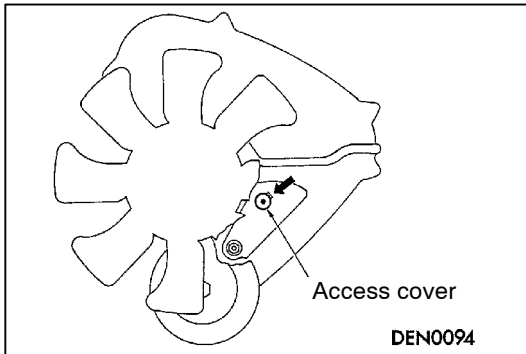
TIMING BELT B TENSION ADJUSTMENT

11100280143

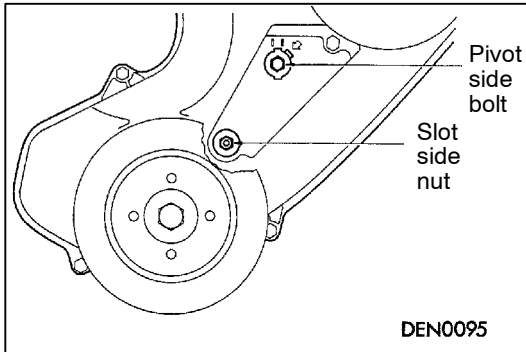
1. Remove timing belt upper cover.
2. Turn the crankshaft in the clockwise direction and check the timing belt around its entire circumference for abnormalities.
3. Align the timing marks on the sprockets with the timing mark on the front upper case.

Caution

When aligning the timing mark, be sure not to turn the crankshaft in the counterclockwise direction as this can cause improper belt tension.



4. Remove the access cover.



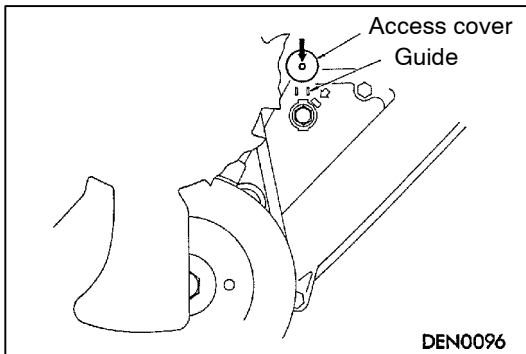
5. Loosen the tensioner pivot side bolt 1 mm and slot side nut 1 or 2 turns.

6. First tighten tensioner slot side nut, and then tighten pivot side bolt to the specified torque.

Tightening torque:

Pivot side bolt 24 Nm

Slot side nut 25 Nm



7. Install the access cover while sliding the front lower cover down along the two guides.

8. Install the timing belt upper cover.

CRANKSHAFT PULLEY

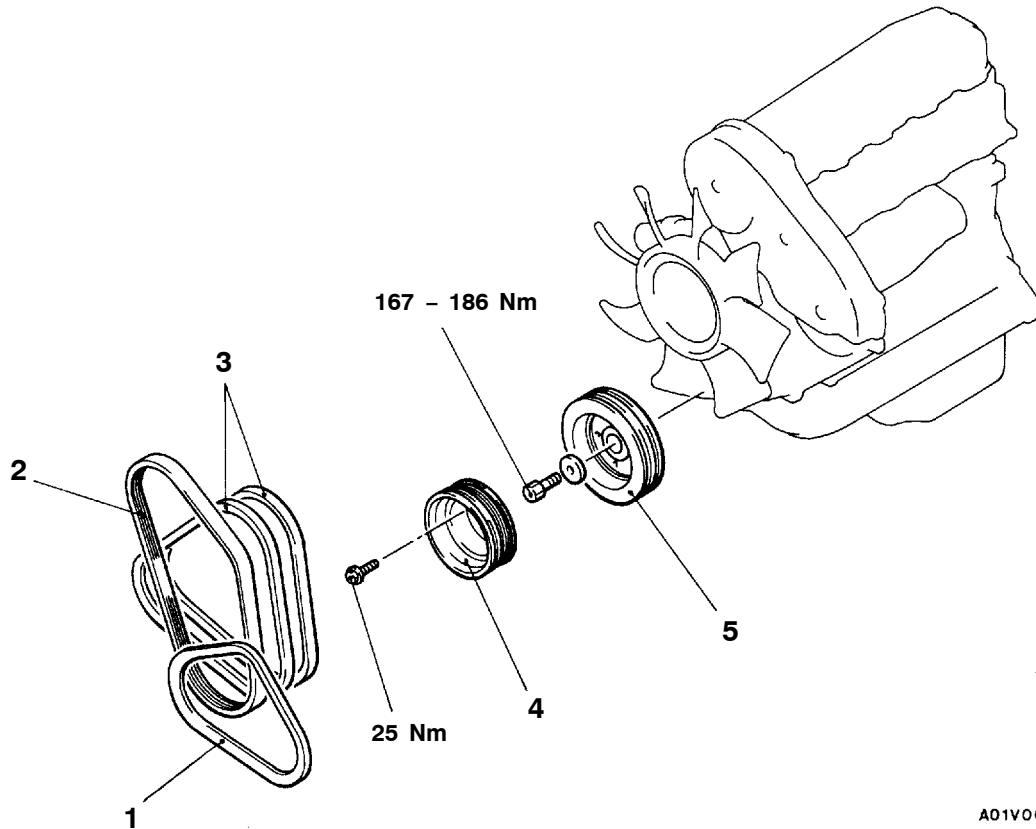
11200160426

REMOVAL AND INSTALLATION**Pre-removal Operation**

- Under Cover Removal

Post-installation Operation

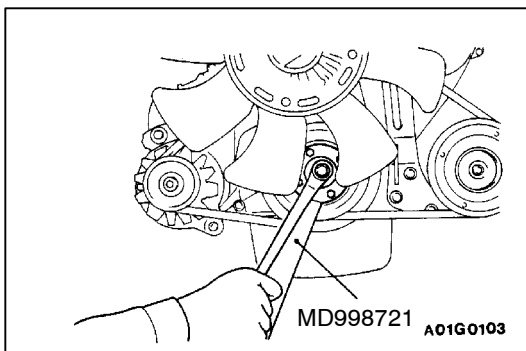
- Drive Belt Tension Adjustment (Refer to P.11B-5.)
- Under Cover Installation



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Removal steps

1. Drive belt (for A/C)
2. Drive belt (for power steering)
3. Drive belt (for alternator)
4. Crankshaft pulley (for power steering or A/C)
5. Crankshaft pulley

**REMOVAL SERVICE POINT**

◀A▶ CRANKSHAFT PULLEY REMOVAL

INSTALLATION SERVICE POINT

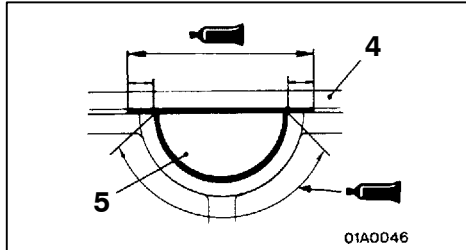
▶A◀ CRANKSHAFT PULLEY INSTALLATION

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

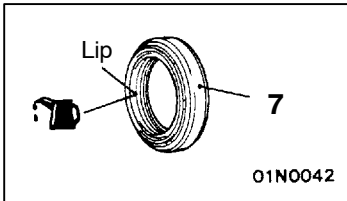
Pre-removal and Post-installation Operation

- Intercooler Removal and Installation
(Refer to GROUP 15.)

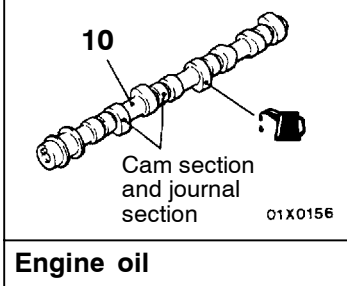


01A0046

Sealant:
3M ATD Part No. 8660 or equivalent

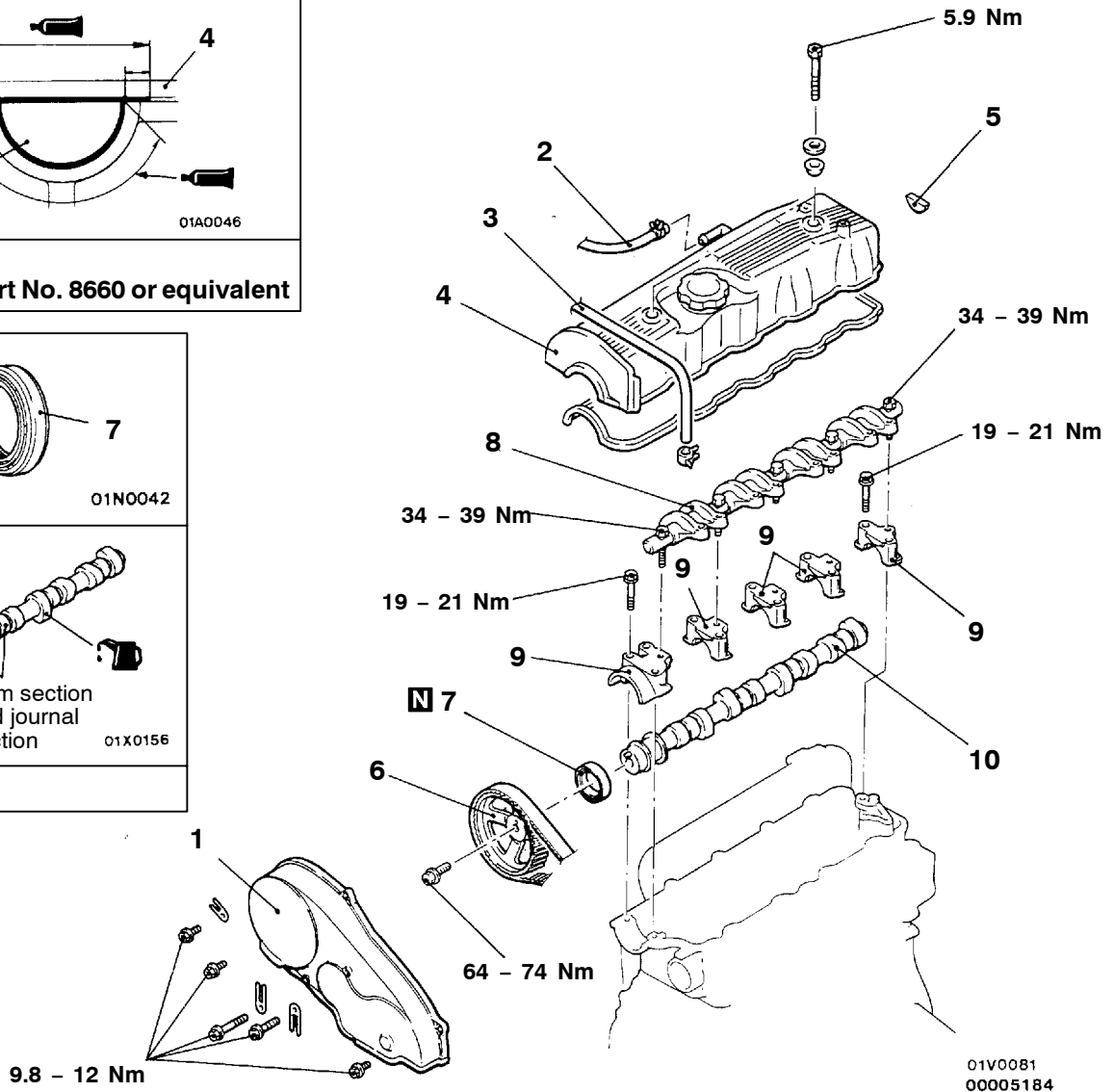


01N0042



01X0156

Engine oil



01V0081
00005184

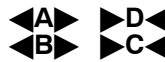
Camshaft removal steps

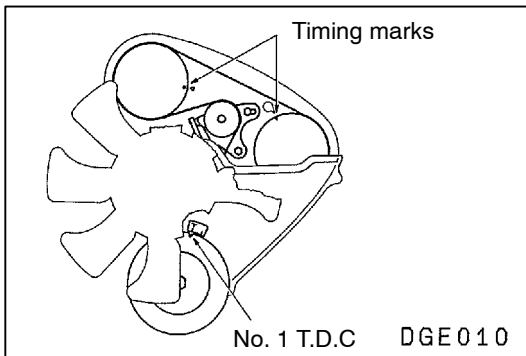
1. Timing belt upper cover assembly
2. Breather hose connection
3. Boost hose connection
4. Rocker cover
5. Semi-circular packing
6. Camshaft sprocket
7. Camshaft oil seal
8. Rocker arm and shaft assembly
9. Camshaft bearing cap
10. Camshaft



Camshaft oil seal removal steps

1. Timing belt upper cover assembly
6. Camshaft sprocket
7. Camshaft oil seal

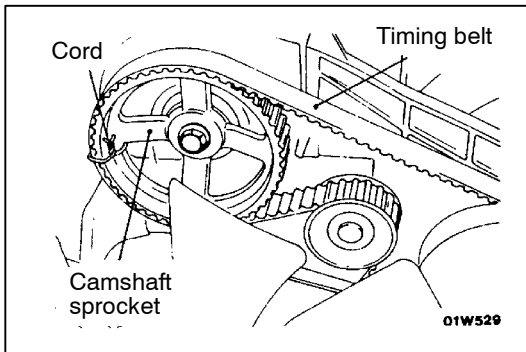


**REMOVAL SERVICE POINTS****◀A▶ CAMSHAFT SPROCKET REMOVAL**

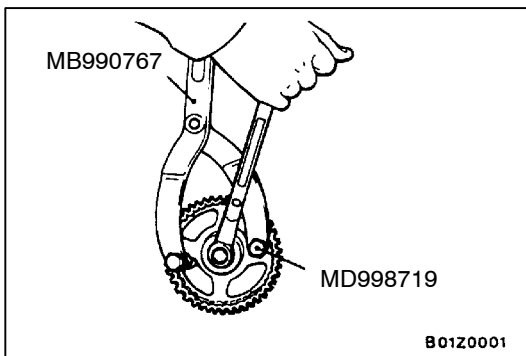
1. Rotate crankshaft clockwise (to the right) and align timing marks.

Caution

Never turn the crankshaft anticlockwise.



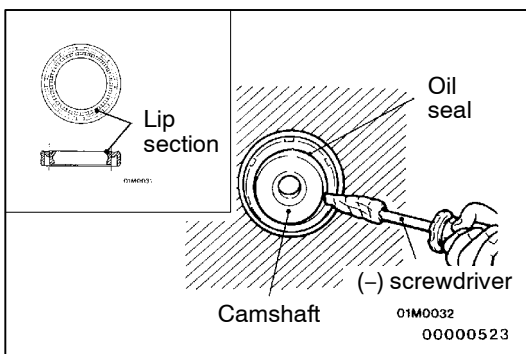
2. Tie the camshaft sprocket and timing belt together with cord so that timing mark is not maladjusted.



3. Use the special tool to stop the camshaft sprocket from turning, and then remove the camshaft sprocket with the timing belt still attached.

Caution

Do not rotate crankshaft after removing camshaft sprocket.

**◀B▶ CAMSHAFT OIL SEAL REMOVAL**

1. Make a notch in the oil seal lip section with a knife, etc.
2. Cover the end of a (-) screwdriver with a rag and insert into the notched section of the oil seal, and lever out the oil seal to remove it.

Caution

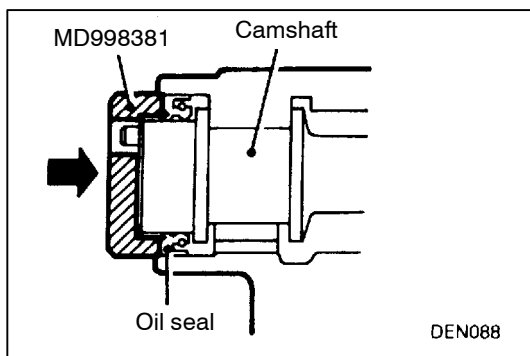
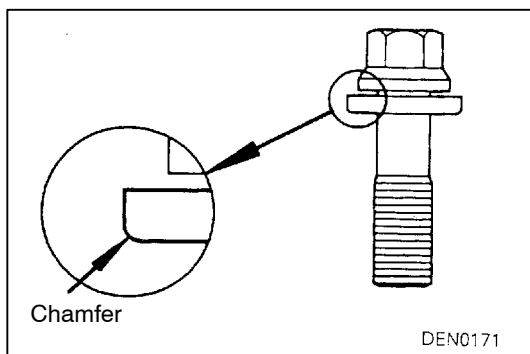
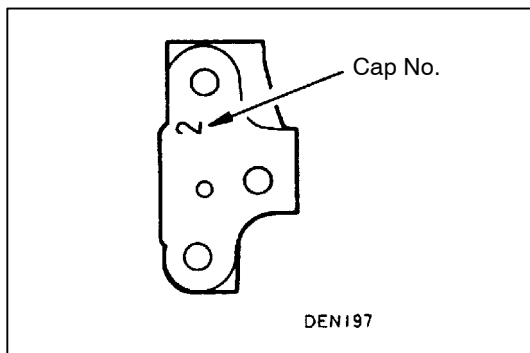
Be careful not to damage the camshaft and the cylinder head.

◀C▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

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

Caution

Never disassemble the rocker arm and shaft assembly.



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 washer so that it faces in the direction shown in the illustration, and then install the bolt.
3. Check the valve clearance and adjust if necessary. (Refer to P.11B-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

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

Tightening torque: 64 – 67 Nm

2. Remove the cord which binds the camshaft sprocket and timing belt.

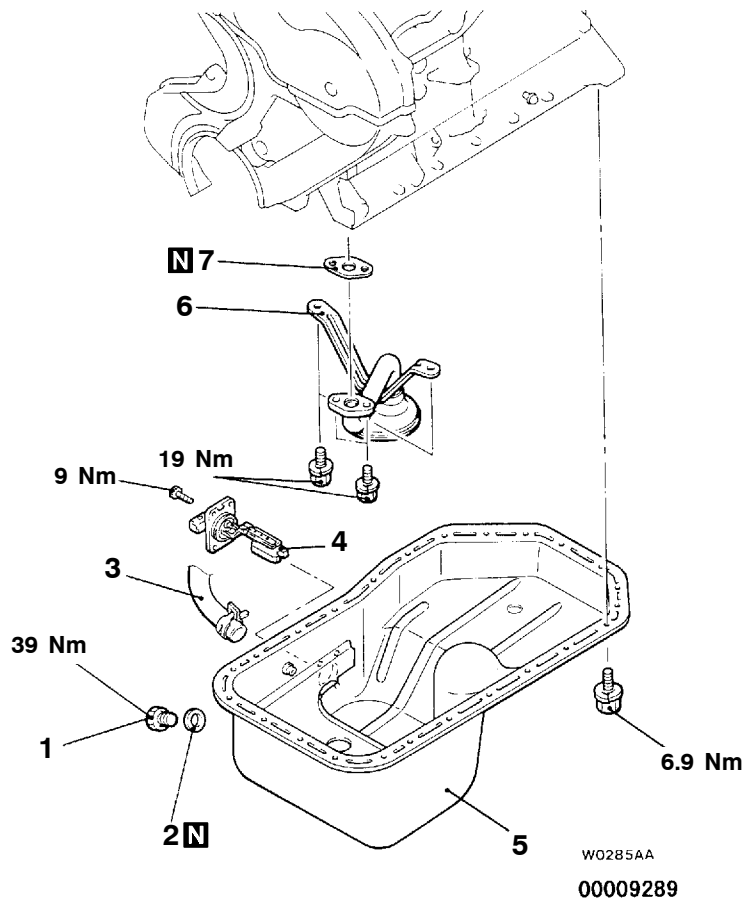
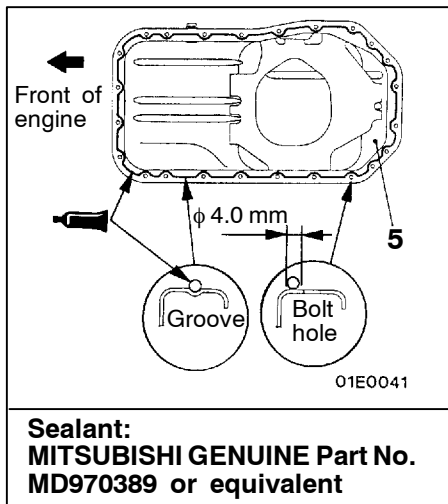
OIL PAN AND OIL SCREEN

11200250451

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

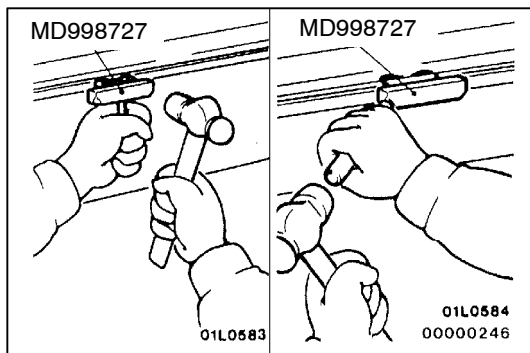
- Under Cover Removal and Installation
- Crossmember Assembly Removal and Installation
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Alternator Removal and Installation (Refer to GROUP 16 – Alternator.)
- Stabilizer Bar Removal and Installation (Refer to GROUP 33A – Stabilizer Bar.)



Removal steps

- B◄
1. Drain plug
 2. Drain plug gasket
 3. Oil return hose connection
 4. Oil level sensor

- ◄A► ►A◄
5. Oil pan
 6. Oil screen
 7. Gasket



REMOVAL SERVICE POINT

◄A► **OIL PAN REMOVAL**

1. Remove oil pan bolts.
2. Tap the special tool in between the oil pan and cylinder block.
3. Slide the special tool by tapping it at an angle to remove the oil pan.

Caution

The use of a screwdriver or chisel in place of the special tool can damage the gasket seat surface and cause oil leakage.

INSTALLATION SERVICE POINTS**▶A◀ OIL PAN INSTALLATION**

1. Remove sealant from oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine mating surface.
3. Apply the specified sealant around the gasket surface of oil pan.

Specified sealant:

mitsubishi GENUINE PART No. MD970389 or equivalent

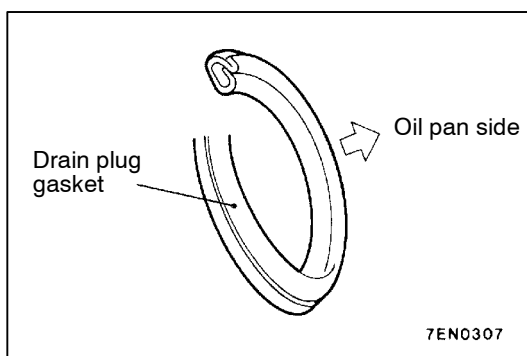
NOTE

The sealant should be applied in a continuous bead approximately 4 mm in diameter.

4. Assemble oil pan to cylinder block within 15 minutes after applying the sealant.

Caution

After installing the oil pan, wait at least 1 hour before starting the engine.

**▶B◀ DRAIN PLUG GASKET INSTALLATION**

Install a new gasket in the direction so that it faces as shown in the illustration.

INSPECTION

11200260041

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

CYLINDER HEAD GASKET

11200401031

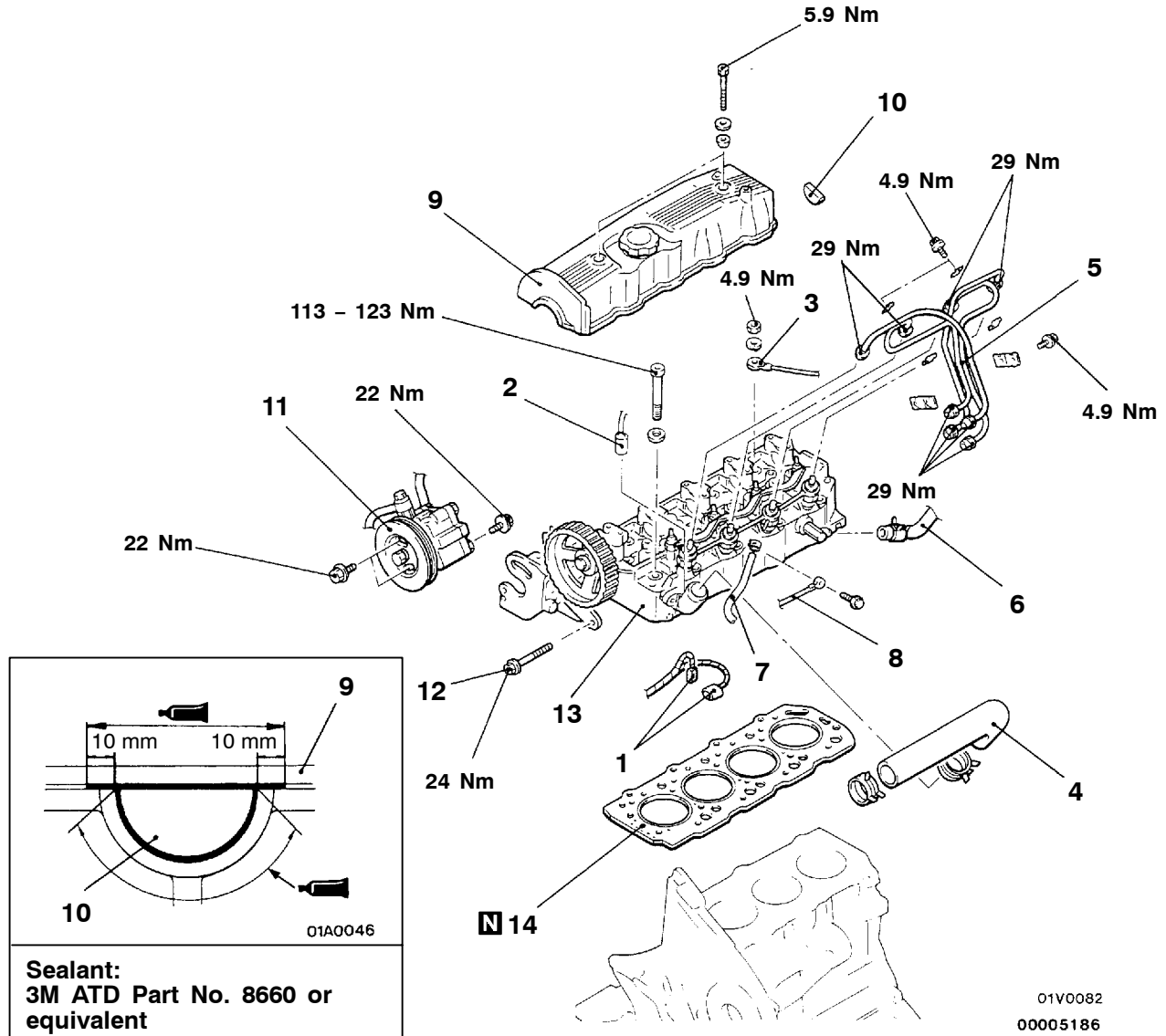
REMOVAL AND INSTALLATION

Pre-removal Operation

- Intake and Exhaust Manifold Removal (Refer to GROUP 15.)
- Timing Belt Removal (Refer to P.11B-26.)
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service.)

Post-installation Operation

- Timing Belt Installation (Refer to P.11B-26.)
- Intake and Exhaust Manifold Installation (Refer to GROUP 15.)
- Fuel Line Air Bleeding (Refer to GROUP 13B – On-vehicle Service.)
- Engine Coolant Filling (Refer to GROUP 14 – On-vehicle Service.)



Removal steps

1. Engine coolant temperature switch connector (for A/C)
2. Engine coolant temperature gauge unit and sensor connector
3. Glow plug terminal
4. Radiator upper hose
5. Fuel injection pipe
6. Heater hose or water by-pass hose connection



7. Fuel hose connection
8. Earth cable connection
9. Rocker cover
10. Semi-circular packing
11. Power steering oil pump assembly
12. Power steering oil pump bracket bolt
13. Cylinder head assembly
14. Cylinder head gasket



REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE DISCONNECTION

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

◀B▶ FUEL INJECTION PIPE REMOVAL

When loosening nuts at both ends of injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with wrench and loosen nut.

Caution

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

◀C▶ POWER STEERING OIL PUMP REMOVAL

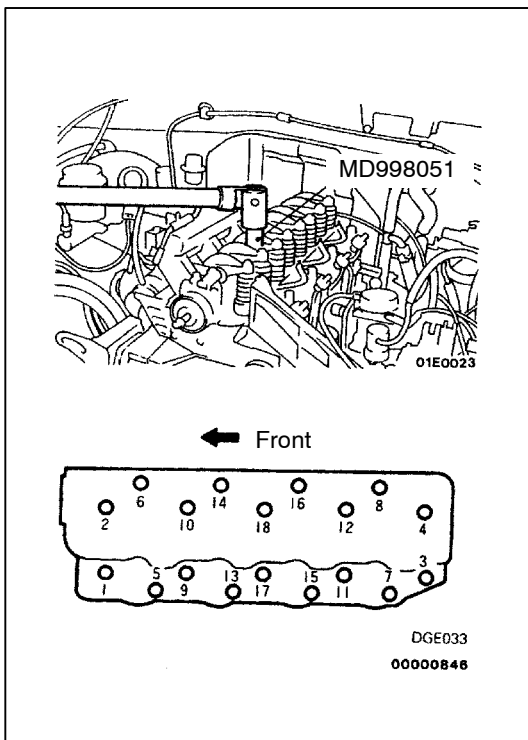
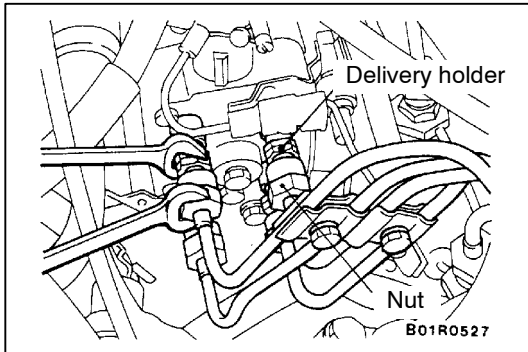
Remove the power steering oil pump from the bracket with the hose attached.

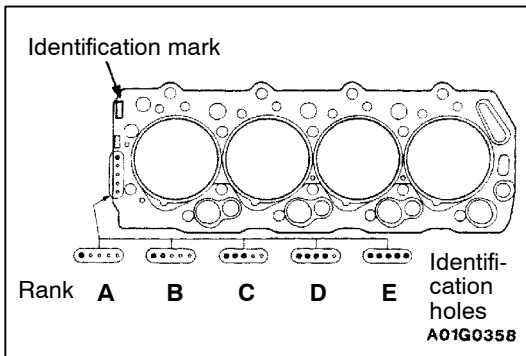
NOTE

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.

◀D▶ CYLINDER HEAD ASSEMBLY REMOVAL

Use the special tool to tighten each bolt 2 – 3 times in the order shown in the illustration.





INSTALLATION SERVICE POINTS

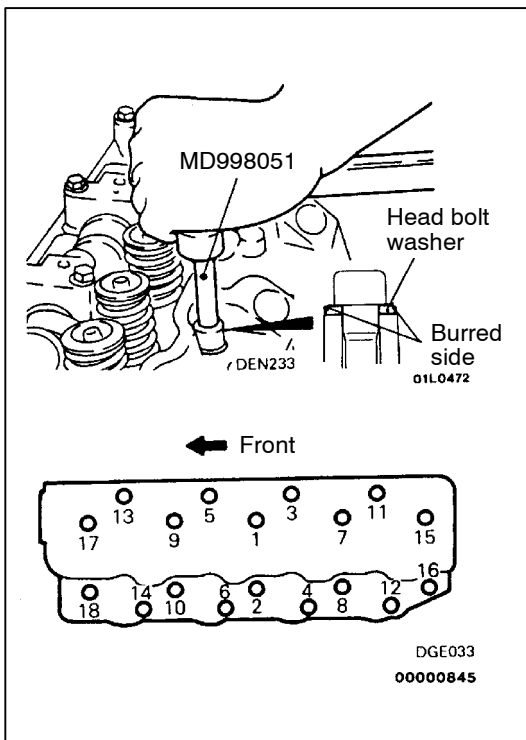
►A◄ CYLINDER HEAD GASKET INSTALLATION

1. Wipe off any oil or grease from the gasket mounting surface.
2. Check the rank from the number of identification holes on the cylinder head gasket that was removed, and select a cylinder head gasket of the same rank.

NOTE

The ranks are listed in the parts catalogue.

3. Place the cylinder head gasket on top of the cylinder block so that the identification mark is facing upwards as in the illustration.



►B◄ CYLINDER HEAD INSTALLATION

Use the special tool to tighten each bolt 2 – 3 times in the order shown in the illustration.

Caution

The head bolt washer should be installed so that the burred side is facing upwards.

►C◄ RADIATOR UPPER HOSE CONNECTION

To reuse the radiator upper hose, align the mating marks that were made during removal, and then install the hose clamp.

►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 injection nozzle assembly (for nozzle side) with a wrench, and tighten the nuts to the specified torque.

TIMING BELT AND TIMING BELT B

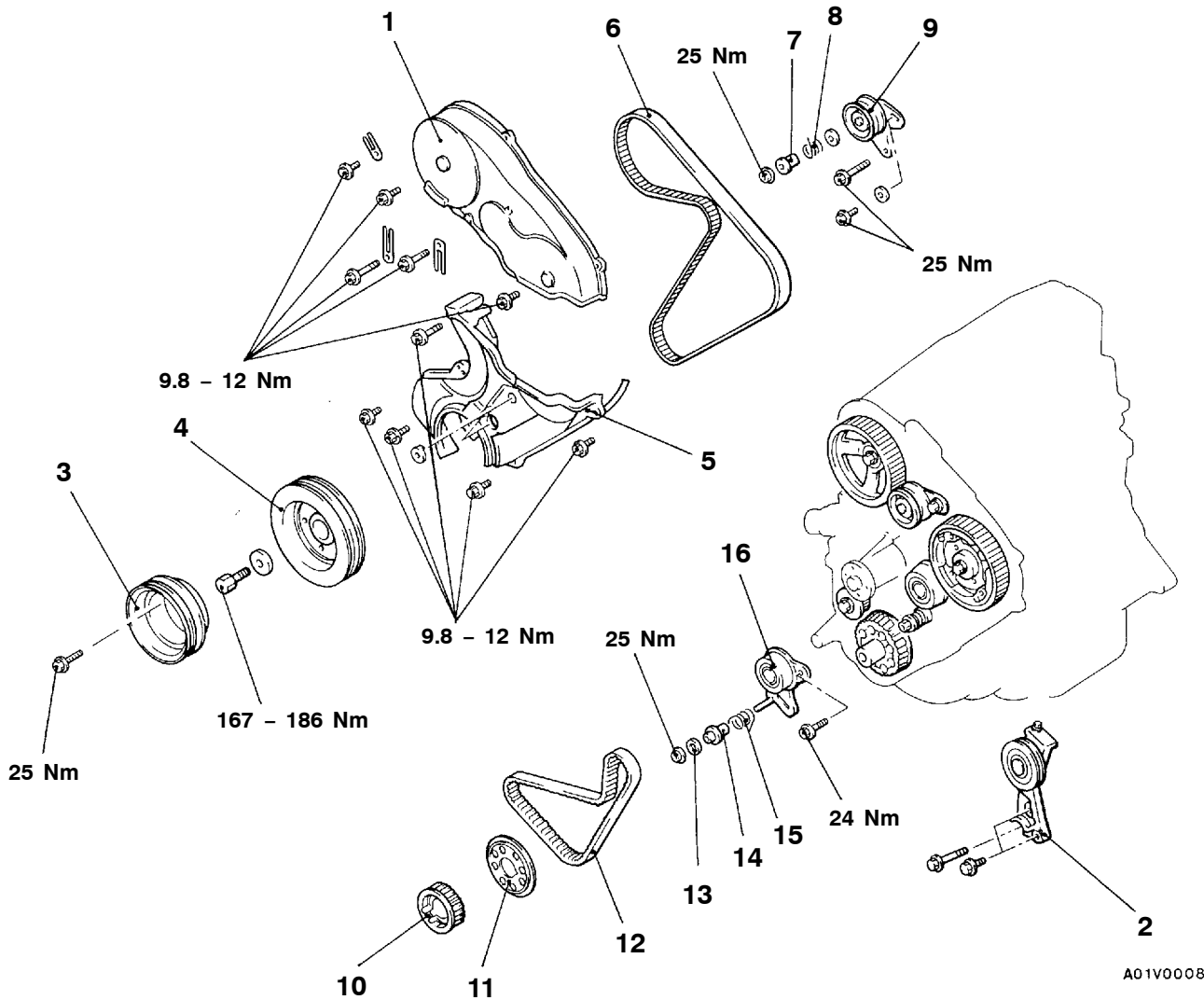
REMOVAL AND INSTALLATION

Pre-removal Operation

- Cooling Fan Removal (Refer to GROUP 14.)

Post-installation Operation

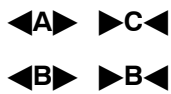
- Cooling Fan Installation (Refer to GROUP 14.)
- Engine Adjustment (Refer to P.11B-5.)



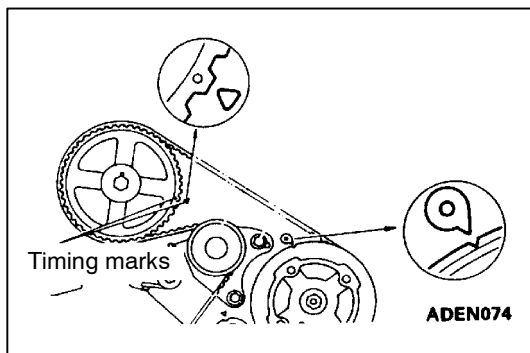
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Removal steps

1. Timing belt front upper cover
2. Tension pulley bracket (for A/C)
3. Crankshaft pulley (for power steering and A/C)
4. Crankshaft pulley
5. Timing belt front lower cover
6. Timing belt
7. Tensioner spacer
8. Tensioner spring



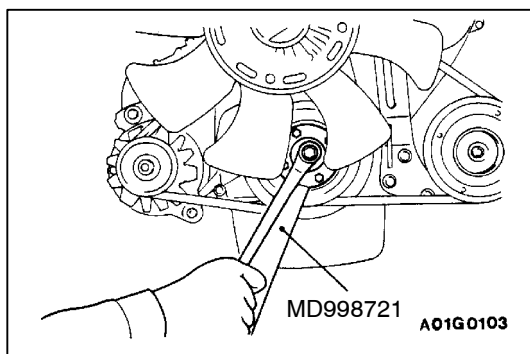
9. Timing belt tensioner assembly
10. Crankshaft sprocket
11. Flange
12. Timing belt B
13. Gasket
14. Tensioner spacer B
15. Tensioner spring B
16. Timing belt tensioner B

**REMOVAL SERVICE POINTS****◀A▶ CRANKSHAFT PULLEY REMOVAL**

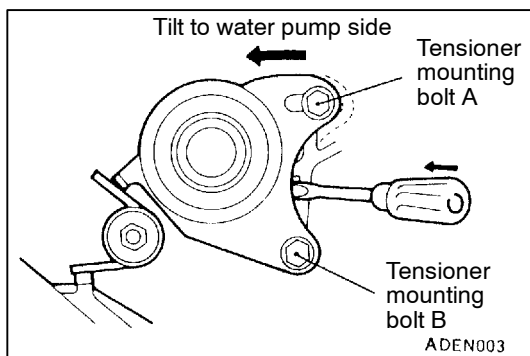
1. Position the No. 1 cylinder at compression TDC and remove the crankshaft pulley.

NOTE

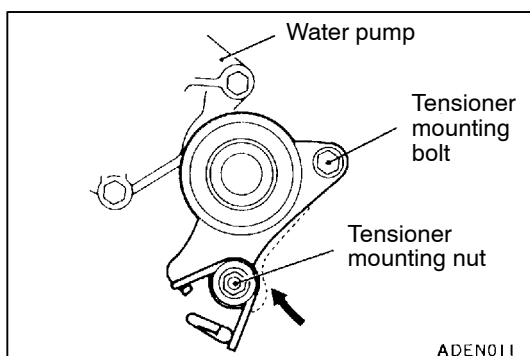
The No. 1 cylinder is at compression TDC when the marks are aligned as shown in the figure.



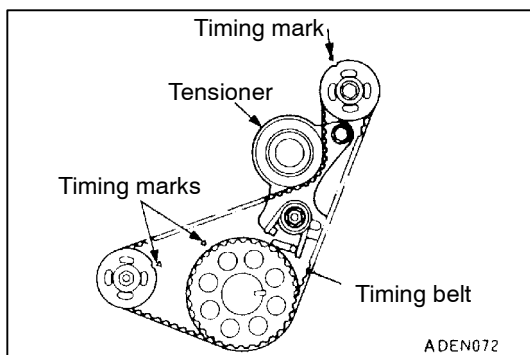
2. Use the special tool to keep crankshaft from turning and remove the bolts.

**◀B▶ TIMING BELT REMOVAL**

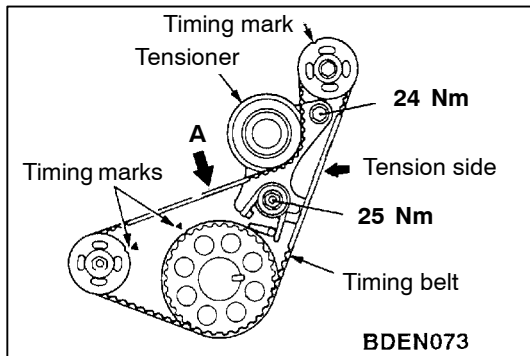
1. When reinstalling timing belt, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt A and B.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt A and B. Secure so that tensioner will not move back.

**◀C▶ TIMING BELT B REMOVAL**

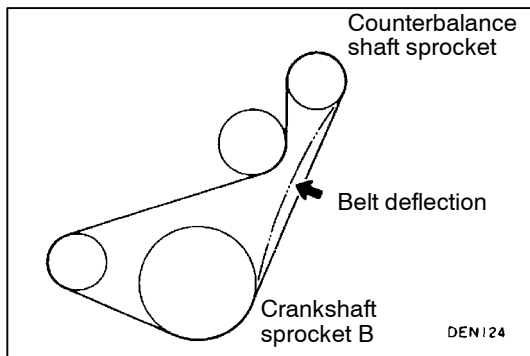
1. When reinstalling timing belt B, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt and nut.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt and nut. Secure so that tensioner will not move back.

**INSTALLATION SERVICE POINTS****▶A▶ TIMING BELT B INSTALLATION**

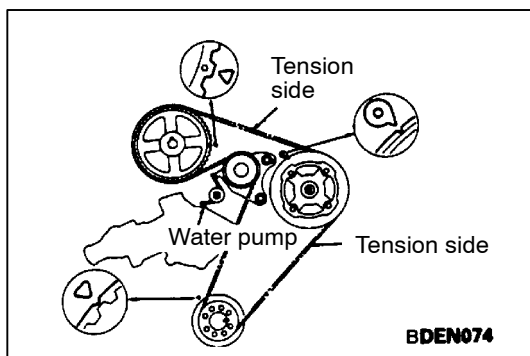
1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt B, make sure the arrow mark is pointing in the same direction as when the belt was removed.



3. Install timing belt B and make sure there is no deflection on the tension side.
4. Press the deflection side of timing belt B (indicated by arrow (A)) with the hand and fully stretch the tensioner side.
5. Make sure that the timing marks are aligned.
6. Loosen the tensioner mounting bolt and nut so that only the pressure of the spring is applied to timing belt B.
7. Tighten the tensioner mounting bolt and nut, tightening the nut first. If the bolt is tightened first, the tensioner will move and tension the belt.



8. Press in the direction of the arrow in the figure with the index finger to check the amount of deflection.
Standard value: 4 – 5 mm

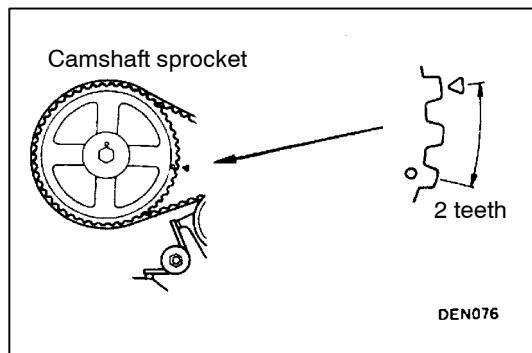


►B◀TIMING BELT INSTALLATION

1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt, make sure the arrow mark is pointing in the same direction as when the belt was removed.
3. Install the timing belt to the crankshaft sprocket, to injection pump sprocket, to tensioner and to camshaft sprocket in that order. Being careful not to allow deflection on the tension side of the timing belt.

Caution

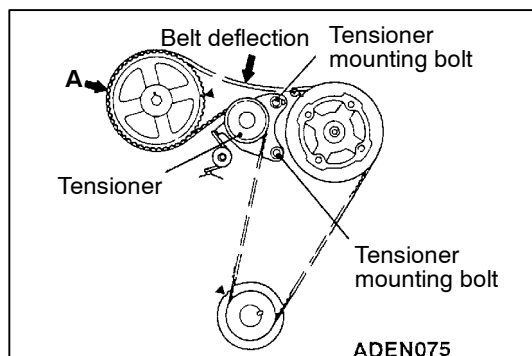
- (1) Engage the belt on the various sprockets while maintaining tension on the belt of tension side.
- (2) Align the injection pump sprocket with the timing mark, hold the sprocket so that it does not turn and engage the belt.



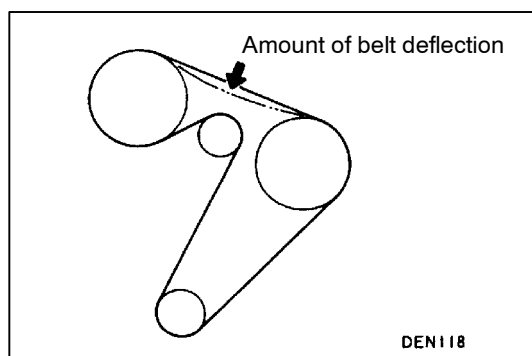
4. Loosen the tensioner mounting bolts and apply tension with the spring.
5. Turn the crankshaft clockwise and stop at the second lobe of the camshaft sprocket.

Caution

- (1) When turning the crankshaft in item (5), strictly observe the specified amount of rotation (2 teeth on the camshaft sprocket) in order to apply a constant force to the tension side of the belt.
- (2) Do not turn the crankshaft counterclockwise.
- (3) Do not touch the belt during adjustment.



6. Make sure that the part indicated by arrow A does not float upward.
7. Tighten the tensioner mounting bolts, starting with the bolt in the elongated hole. If the lower bolt is tightened first, belt tension will become too tight.



8. Turn the crankshaft anticlockwise and align the timing mark. Next, make sure that the timing marks of all sprockets are aligned.
9. Press on the centre of the bolt with an index finger to check the amount of deflection.

Standard value: 4 – 5 mm

►C◄ CRANKSHAFT PULLEY INSTALLATION

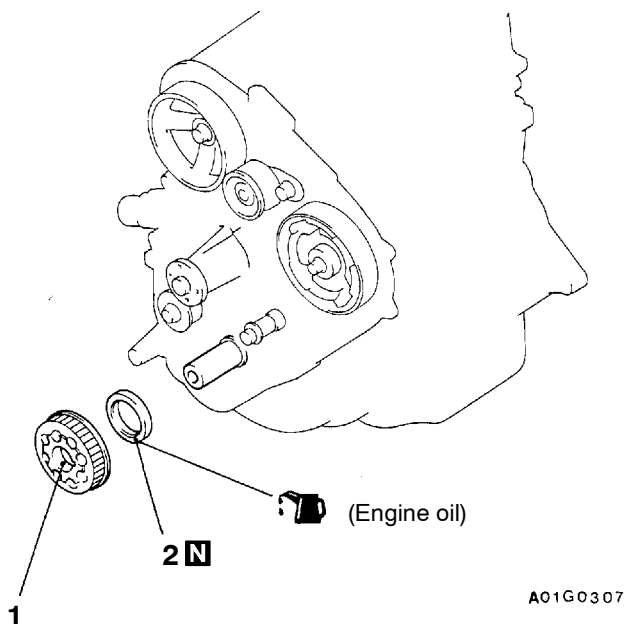
Using the special tool to install the crankshaft pulley as same as removal procedure.

CRANKSHAFT FRONT OIL SEAL

REMOVAL AND INSTALLATION

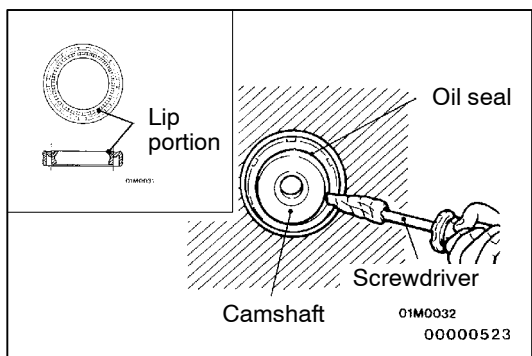
Pre-removal and Post-installation Operation

- Timing Belt and Timing Belt “B” Removal and Installation (Refer to P.11B-26.)



Removal steps

- ◀A▶ ▶A◀
1. Crankshaft sprocket B
 2. Oil seal



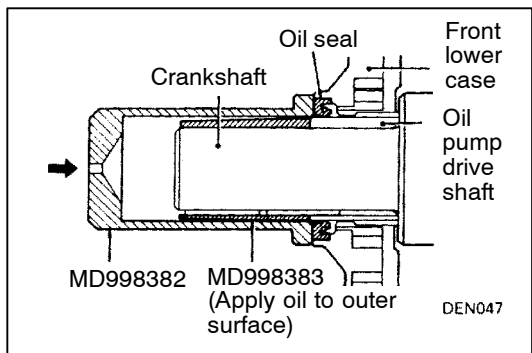
REMOVAL SERVICE POINT

◀A▶ OIL SEAL REMOVAL

1. Cut out a portion in the crankshaft oil seal lip.
2. Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution

Be careful not to damage the crankshaft and front case.



INSTALLATION SERVICE POINT

▶A◀ OIL SEAL INSTALLATION

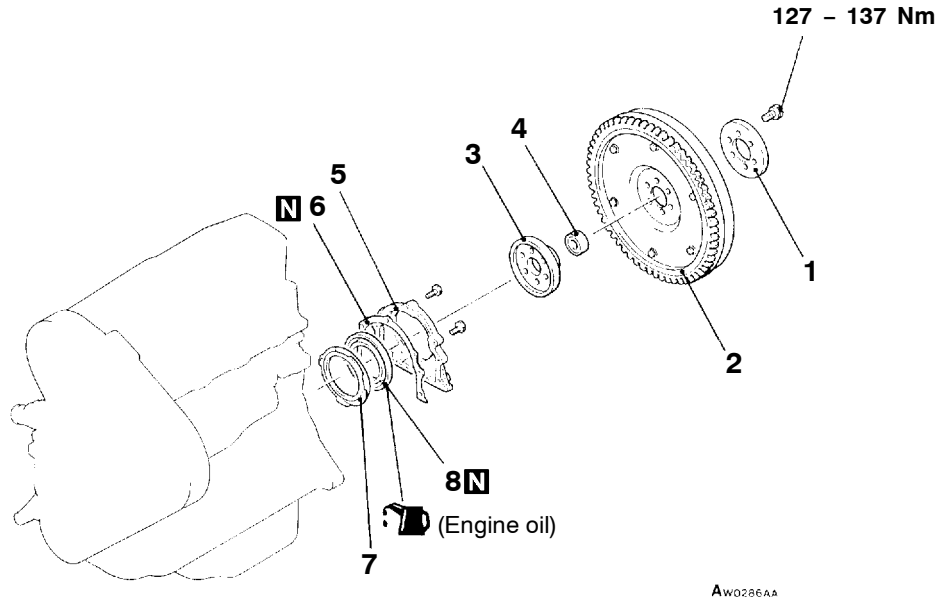
Apply engine oil to the outside of the special tool (MD998383) and to the oil seal lip, and use the special tool to press-fit the oil seal.

CRANKSHAFT REAR OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Oil Pan Removal and Installation (Refer to P.11-21.)
- Transmission Assembly Removal and Installation (Refer to GROUP 22.)

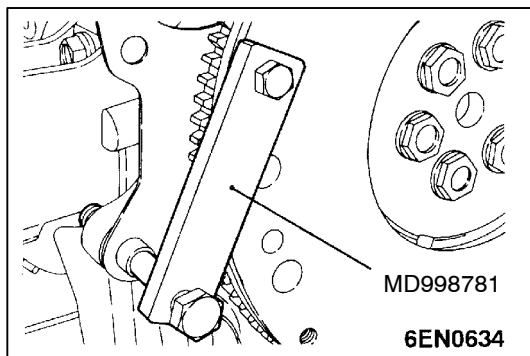


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Removal steps

- ◀A▶ ▶C▶
1. Adapter
 2. Flywheel assembly
 3. Crankshaft adaptor
 4. Ball bearing

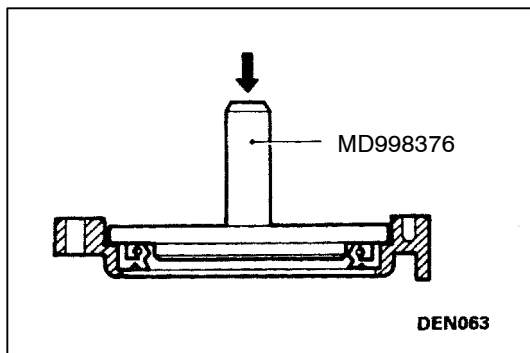
- ▶B▶
▶A▶
5. Oil seal case
 6. Gasket
 7. Oil separator
 8. Oil seal



REMOVAL SERVICE POINT

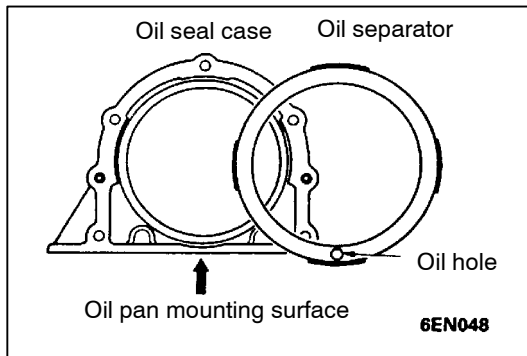
◀A▶ **FLYWHEEL ASSEMBLY REMOVAL**

Use the special tool to secure the flywheel assembly and remove the bolt.



INSTALLATION SERVICE POINTS

▶A▶ **OIL SEAL INSTALLATION**

**►B◄ OIL SEPARATOR INSTALLATION**

Install the oil separator in such a way that its oil hole come at the case bottom (indicated by an arrow in the illustration).

►C◄ FLYWHEEL ASSEMBLY INSTALLATION

Use the special tool in the same way as during removal to stop the flywheel assembly from turning, and then tighten the bolt to the specified torque.

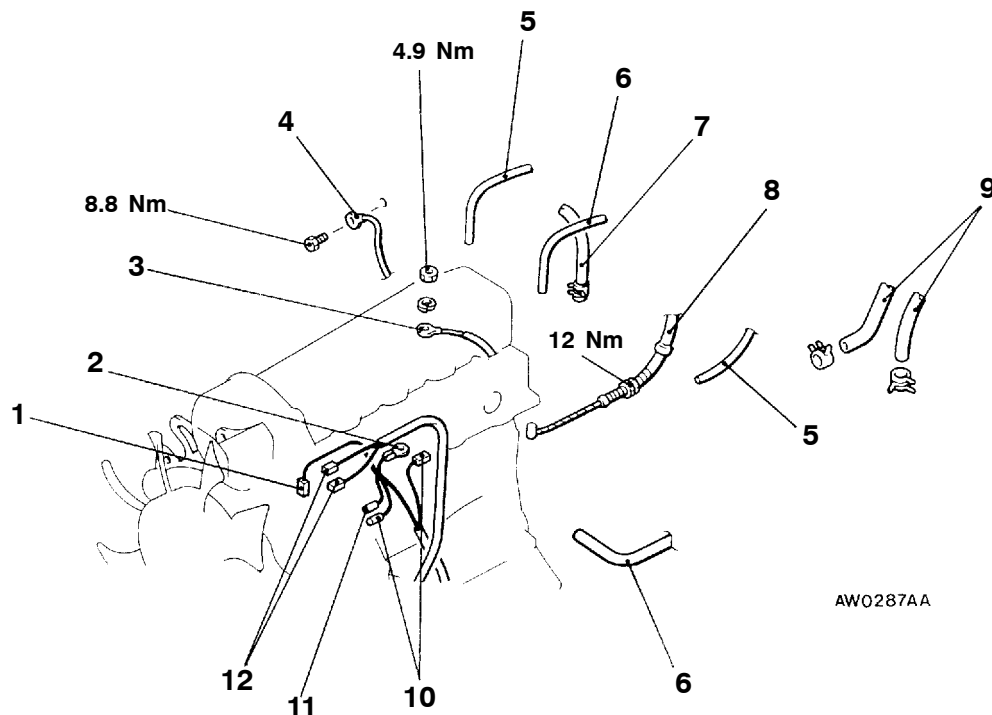
Tightening torque: 127 – 137 Nm

ENGINE ASSEMBLY**REMOVAL AND INSTALLATION****Pre-removal Operation**

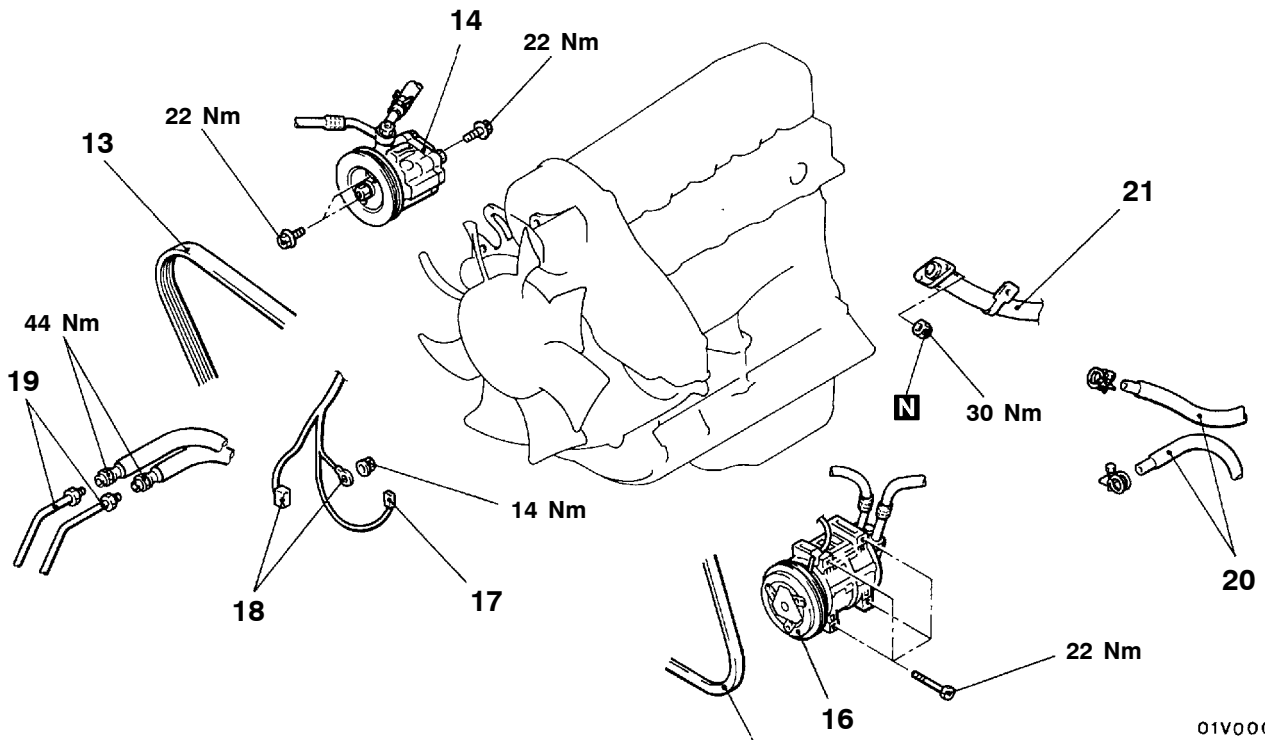
- Hood Removal (Refer to GROUP 42.)
- Intercooler Removal (Refer to GROUP 15.)
- Air Cleaner and Air Intake Hose Removal (Refer to GROUP 15.)
- Brake Master Cylinder Heat Protector Removal
- Battery Removal
- Radiator Removal (Refer to GROUP 14.)
- Transmission and Transfer Assembly Removal (Refer to GROUP 22.)

Post-installation Operation

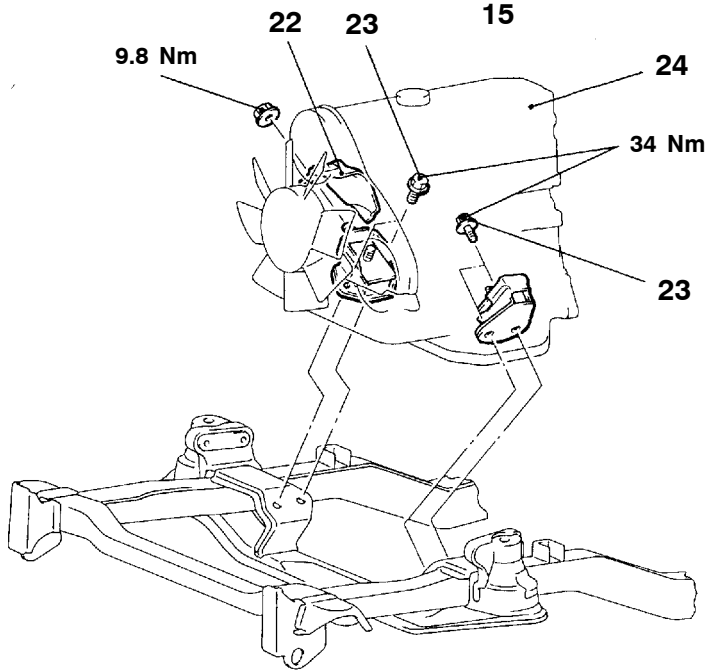
- Transmission and Transfer Assembly Installation (Refer to GROUP 22.)
- Radiator Installation (Refer to GROUP 14.)
- Battery installation
- Brake Master Cylinder Heat Protector Installation
- Air Cleaner and Air Intake Hose Installation (Refer to GROUP 15.)
- Intercooler Installation (Refer to GROUP 15.)
- Hood Installation (Refer to GROUP 42.)
- Drive Belt Tension Adjustment (Refer to P.11B-5.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)

**Removal steps**

1. Engine coolant temperature sensor and gauge unit connector
2. Earth cable connector
3. Glow plug terminal
4. Earth cable connector
5. Vacuum hose connection (for A/C)
6. Vacuum hose connection (for ABS)
7. Brake booster vacuum hose connection
8. Accelerator cable connection
9. Heater hose connections
10. Fuel cut solenoid valve or fuel cut valve controller connector
11. Revolution pick-up sensor connector
12. Engine coolant temperature switch connector (for A/C)



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- 13. Drive belt (for Power steering)
- 14. Power steering oil pump assembly
- 15. Drive belt (for A/C)
- 16. A/C compressor assembly
- 17. Engine oil pressure switch connector
- 18. Alternator connector



- 19. Engine oil cooler hose connection
- 20. Fuel hose connections
- 21. Front exhaust pipe connection
- 22. Heat protector
- 23. Engine support front insulator attaching bolt
- 24. Engine assembly

REMOVAL SERVICE POINTS**◀A▶ POWER STEERING OIL PUMP ASSEMBLY AND A/C COMPRESSOR ASSEMBLY REMOVAL**

1. Remove the oil pump and A/C compressor (with the hose attached).
2. Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

◀B▶ ENGINE ASSEMBLY REMOVAL

1. Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
2. Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

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

Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.

NOTES