

ENGINE <2.4L>

CONTENTS

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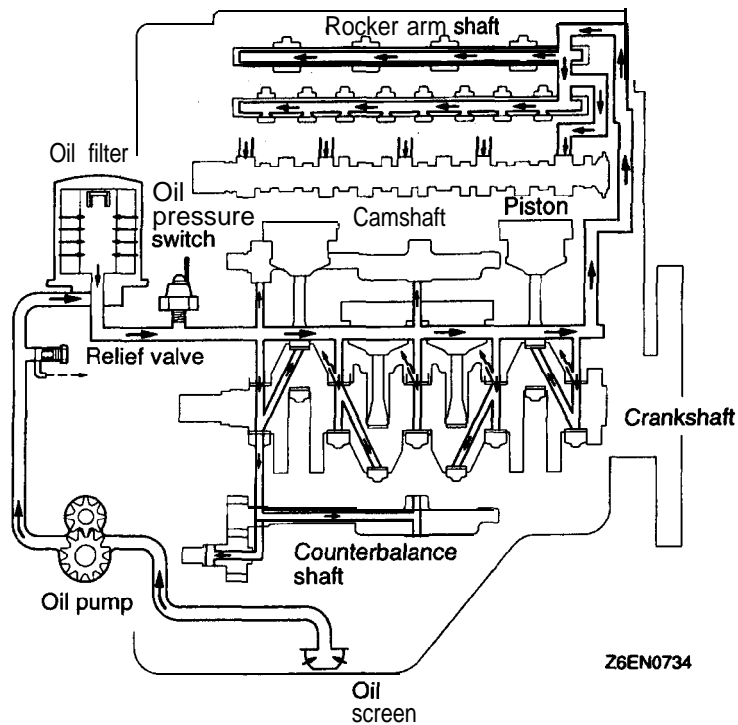
CAMSHAFT AND CAMSHAFT OIL SEAL	21	Compression Pressure Check	11
CRANKSHAFT FRONT OIL SEAL	26	Curb Idle Speed Check	10
CRANKSHAFT PULLEY	20	Drive Belt Tension Check and Adjustment	7
CRANKSHAFT REAR OIL SEAL	27	Idle Mixture Check	10
CYLINDER HEAD GASKET	29	Ignition Timing Check	9
ENGINE ASSEMBLY	15	Lash Adjuster Check	13
GENERAL INFORMATION	2	Manifold Vacuum Check	12
OIL PAN AND OIL SCREEN	24	SEALANTS	3
ON-VEHICLE SERVICE	7	SERVICE SPECIFICATIONS	3
Basic Idle Speed Adjustment	Refer to GROUP 13A	SPECIAL TOOLS	4
		TIMING BELT	35
		TIMING BELT B	39
		TROUBLESHOOTING	6

GENERAL INFORMATION

11100010148

Items		Specifications	
Type		In-line OHV, SOHC	
Number of cylinders		4	
Bore mm(in.)		86.5(3.41)	
Stroke mm(in.)		1 00(3.94)	
Piston displacement cm ³ (cu.in.)		2,351(143.4)	
Compression ratio		9.5	
Firing order		1-3-4-2	
Counterbalance shaft		Equipped	
Valve timing	Intake valve	Opens	18° BTDC
		Closes	58° ABDC
	Exhaust valve	Opens	58° BBDC
		Closes	18° ATDC
Lubrication system		Pressure feed-full flow filtration	

LUBRICATION SYSTEM



SERVICE SPECIFICATIONS

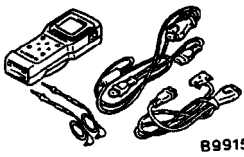
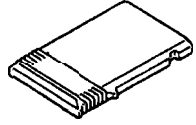
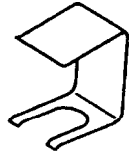
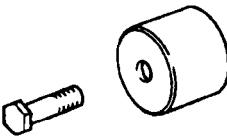

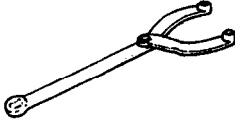
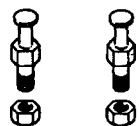
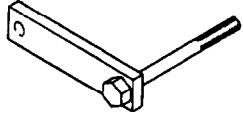
Items			Standard value	Limit
Drive belt (For generator)	Tension N (lbs.)	When checked When a new belt is installed When a used belt is installed	245 – 490 (55.1 – 110.2) 490 – 686 (110.2 – 154.3) 392 (88.2)	–
	Deflection mm (in.) <Reference value>	When checked When a new belt is installed When a used belt is installed	9.0 – 11.5 (.35 – .45) 7.5 – 9.0 (.30 – .35) 10.0 (.39)	–
Drive belt (For power steering pump)	Tension N (lbs.)	When checked When a new belt is installed When a used belt is installed	245 – 490 (55.1 – 110.2) 490 – 686 (110.2 – 154.3) 343 – 441 (77.2 – 99.2)	–
	Deflection mm (in.)	When checked When a new belt is installed When a used belt is installed	5.5 – 8.0 (.22 – .32) 4.5 – 5.5 (.18 – .22) 6.0 – 7.0 (.24 – .28)	–
Drive belt (For A/C compressor)	Tension N (lbs.)	When checked When a new belt is installed When a used belt is installed	255 – 333 (57.3 – 75.0) 382 – 441 (86.0 – 99.2) 255 – 333 (57.3 – 75.0)	–
	Deflection mm (in.)	When checked When a new belt is installed When a used belt is installed	6.5 – 7.5 (.26 – .30) 5.5 – 6.0 (.22 – .24) 6.5 – 7.5 (.26 – .30)	–
Basic ignition timing at idle			5° BTDC ± 3"	–
Actual ignition timing at idle			Approx. 10° BTDC	–
Curb idle speed r/min			750 ± 100	
CO contents %			0.5 or less	
HC contents ppm			100 or less	–
Compression pressure (at 250 – 400 r/min) kPa (psi)			1,350 (192)	min. 1,020 (145)
Compression pressure difference of all cylinder kPa (psi)				max. 100 (14)
Intake manifold vacuum kPa (in. Hg)				min. 60 (18)
Cylinder head bolt length mm (in.)				99.4 (3.91)
Auto tensioner push rod movement mm (in.)			Within 1 (.04)	
Timing belt tension torque Nm (ft.lbs)			3.5 (2.6)	–
Auto tensioner rod protrusion mm (in.)			3.8 – 4.5 (.150 – .177)	–
Timing belt B tension mm (in.)			5 – 7 (.20 – .28)	

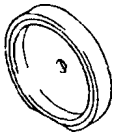
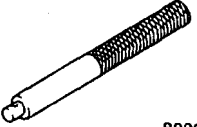
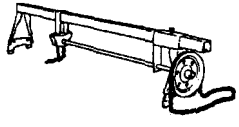
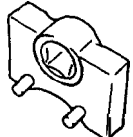

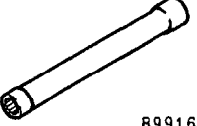
SEALANTS

Items	Specified sealant
Oil pan, cylinder block and thermostat case assembly	mitsubishi GENUINE PART MD970389 or equivalent
Flywheel bolt or drive plate bolt	3M Stud locking 4170 or equivalent

SPECIAL TOOLS

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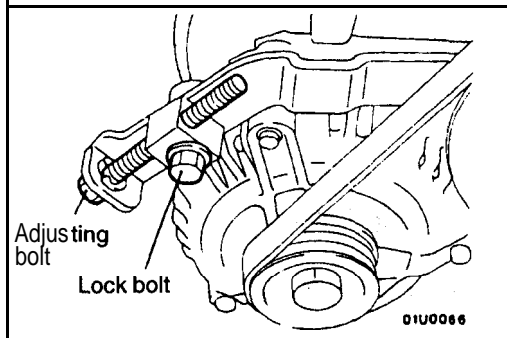
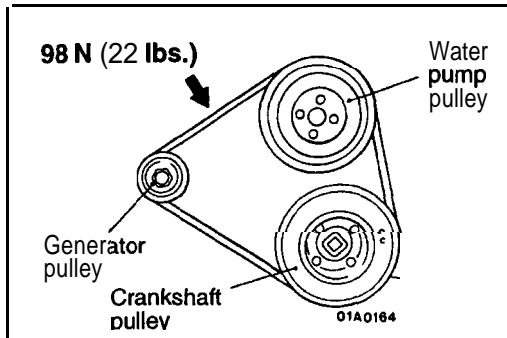
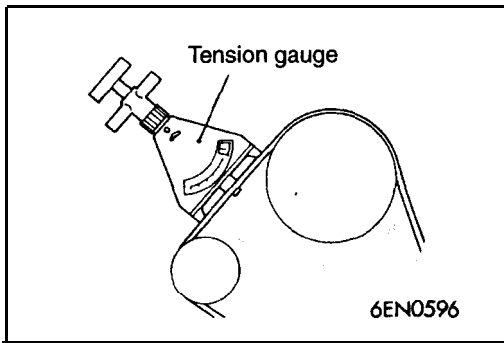
Tool	Tool number and name	Supersession	Application
 8991502	MB991502 Scan tool (MUT-II)	MB991 502	Idle speed inspection
 8991325	ROM pack		
	MD998443 Lash adjuster holder	MD998443-01	Supporting of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed
	MD998713 Canshaft oil seal installer	MD998713-01	Camshaft oil seal installation
	MD998727 Oil pan gasket cutter	MD998727-01	Oil pan removal
	MB990767 End yoke holder	MB990767-01	Holding camshaft sprocket or crankshaft pulley when loosening and tightening of bolt. Use with MD998754 , MD998719
	MD998719 or MD998754 Crankshaft pulley holder	MIT308239	Supporting the crankshaft pulley when crankshaft bolt and pulley are removed or reinstalled. Use together with MB990767 Camshaft pulley supporting
	MD998781 Flywheel stopper	General service tool	Flywheel <M/T> or drive plate <A/T> supporting

Tool	Tool number and name	Supersession	Application
	MD998776 Crankshaft rear oil seal installer	MD998776-01	Crankshaft rear oil seal installation
 <p style="text-align: center;">B990938</p>	MB990938 Handle	MB990938-01	
 <p style="text-align: center;">Z203827</p>	GENERAL SERVICE TOOL MZ203827 Engine lifter	MZ203827-01	Supporting engine assembly when removing and installing transaxle
	MD998767 Tensioner pulley wrench	MD998752-01	Auto tensioner installation
	MD998778 Crankshaft sprocket puller	General service tool	Crankshaft sprocket removal
 <p style="text-align: center;">B991654</p>	MB991 654 Cylinder head bolt wrench (12)	-	Removal and installation of cylinder head bolt

TROUBLESHOOTING

11100070045

Symptom	Probable cause	Remedy
Compression too low	Cylinder head gasket blown	Replace gasket
	Piston ring worn or damaged	Replace rings
	Piston or cylinder worn	Repair or replace piston and/or cylinder block
	Valve seat worn or damaged	Repair or replace valve and/or seat ring
Oil pressure drop	Engine oil level too low	Check engine oil level
	Oil pressure switch faulty	Replace oil pressure switch
	Oil filter clogged	Install new filter
	Oil pump gears or cover worn	Replace gears and/or cover
	Thin or diluted engine oil	Change engine oil to correct viscosity
	Oil relief valve stuck (open)	Repair relief valve
	Excessive bearing clearance	Replace bearings
Oil pressure too high	Oil relief valve stuck (closed)	Repair relief valve
Noisy valves	Incorrect lash adjuster	Bleed air or replace lash adjuster
	Thin or diluted engine oil (low oil pressure)	Change engine oil
	Valve stem or valve guide worn or damaged	Replace valve and/or guide
Connecting rod noise/ main bearing noise	Insufficient oil supply	Check engine oil level
	Low oil pressure	Refer to "Oil pressure drop"
	Thin or diluted engine oil	Change engine oil
	Excessive bearing clearance	Replace bearings
Timing belt noise	Incorrect belt tension	Adjust belt tension and/or replace timing belt
Excessive engine rolling and vibration	Loose engine roll stopper (Front, Rear)	Retighten
	Loose transaxle mount bracket	Retighten
	Loose engine mount bracket	Retighten
	Loose center member	Retighten
	Broken transaxle mount insulator	Replace
	Broken engine mount insulator	Replace
	Broken roll stopper insulator	Replace



ON-VEHICLE SERVICE

11100090234

DRIVE BELT TENSION CHECK AND ADJUSTMENT

GENERATOR DRIVE BELT TENSION CHECK

Use the belt tension gauge to check belt tension **at** the shown point or check deflection by applying **98 N (22 lbs.)** to the shown point.

Standard value:

Tension: 245 – 490 N (55.1 – 110.2 lbs.)

Deflection <Reference, value>:

9.0 – 11.5 mm (.35 – .45 in.)

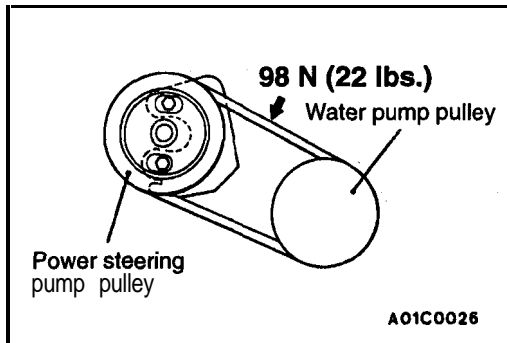
GENERATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the generator pivot bolt.
2. Loosen the lock bolt.
3. Turn the adjusting bolt to adjust the belt tension or deflection to the standard value.

Standard value:

Items	When a new belt is installed	When a used belt is installed
Tension N (lbs.)	490–686 (110.2–154.3)	392 (88.2)
Deflection mm (in.) <Reference value>	7.5–9.0 (.30–.35)	10.0 (.39)

4. Tighten the nut of the generator pivot bolt.
Tightening torque: 23 Nm (17 ft.lbs.)
5. Tighten the lock bolt.
Tightening torque: 23 Nm (17 ft.lbs.)
6. Tighten the adjusting bolt.
Tightening torque: 10 Nm (7 ft.lbs.)



POWER STEERING PUMP DRIVE BELT TENSION CHECK

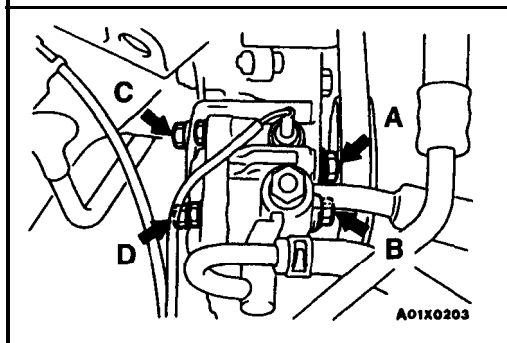
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Use the belt tension gauge to check belt tension at the shown point or check deflection by applying 98 N (22 lbs.) to the shown point.

Standard value:

Tension: 245 - 490 N (55.1 - 110.2 lbs.)

Deflection: 5.5 - 8.0 mm (.22 - .32 in.)



POWER STEERING PUMP DRIVE BELT TENSION ADJUSTMENT

1. Loosen power steering pump fixing bolt (A, B, C, D).
2. Move power steering pump, tension belt moderately and adjust tension.

Standard value:

Items	When a new belt is installed	When a used belt is installed
Tension N (lbs.)	490-686 (110.2-154.3)	343-441 (77.2-99.2)
Deflection mm (in.)	4.5-5.5 (.18-.22)	6.0-7.0 (.24-.28)

3. Tighten fixing bolt (A).

Tightening torque: 28 Nm (21 ft.lbs.)

4. Tighten the remaining fixing bolts (B, C and D).

Tightening torque:

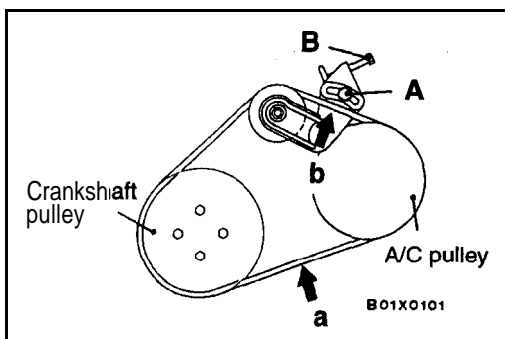
Bolt B and D 28 Nm (21 ft.lbs.)

Bolt C 22 Nm (16 ft.lbs.)

5. Check the belt deflection amount and readjust if necessary.

Caution

This check should be carried out after turning the crankshaft one full rotation or more in the forward direction (to the right).



A/C COMPRESSOR DRIVE BELT TENSION CHECK

11100100098

Use the belt tension gauge to check belt tension at the shown point (a) or (b), or check deflection by applying 98 N (22 lbs.) to the shown point.

Standard value:

Tension: 255 - 333 N (57.3 - 75.0 lbs.)

Deflection: 6.5 - 7.5 mm (.26 - .30 in.)

A/C COMPRESSOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen tension pulley fixing nut A.
2. Adjust belt tension with adjusting bolt B.

Standard value:

Items	When a new belt is installed	When a used belt is installed
Tension N (lbs.)	382-411 (86.0–99.2)	255-333 (57.3–75.0)
Deflection mm (in.)	5.5–6.0 (.22–.24)	8.5-7.5 (.26–.30)

3. Tighten fixing nut A.

Tightening torque: 23-26 Nm (17–20 ft.lbs.)

4. Check the belt deflection amount and readjust if necessary.

Caution

This check should be carried out after turning the crankshaft one full rotation or more in the forward direction (to the right).

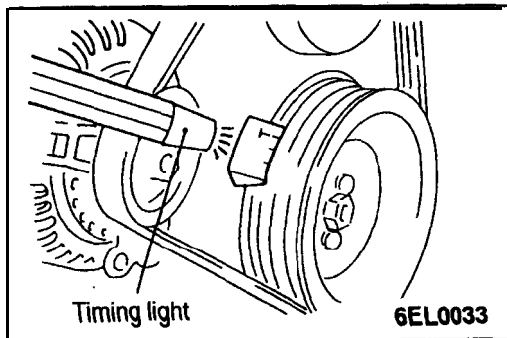
IGNITION TIMING CHECK

11100170198

1. Before inspection and adjustment set vehicle in the following condition.
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lights, electric cooling fan and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)
2. Turn the ignition switch to OFF and connect the scan tool to the data link connector.
3. Set up a timing light.
4. Start the engine and run at idle.
5. Select No. 22 of the SCAN TOOL DATA LIST.
6. Check that engine idle speed is within the standard value.

Standard value: 750 ± 100 r/min

7. Select No. 17 of the SCAN TOOL ACTUATOR TEST.



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

Standard value: 5° BTDC ± 3°

9. If the basic ignition timing is outside the standard value, inspect the MFI components by referring to GROUP 13A – Troubleshooting.

10. Press the scan tool clear key (select a forced driving cancel mode) to release the ACTUATOR TEST

NOTE

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

11. Check that the actual ignition timing is at the standard value.

Standard value: Approx. 10° BTDC

NOTE

1. Ignition timing is variable within about $\pm 7^\circ$, even under normal operating.
2. And it is automatically further advanced by about 5° from 10° BTDC at higher altitudes.

CURB IDLE SPEED CHECK

11100190392

1. Before inspection and adjustment, set vehicles in the following condition.
 - Engine coolant temperature: $80\text{--}95^\circ\text{C}$ ($176\text{--}203^\circ\text{F}$)
 - Lights, electric cooling fan and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)
2. Turn the ignition switch to OFF and connect the scan tool to the data link connector.
3. Select No. 17 of the SCAN TOOL ACTUATOR TEST
4. Check the basic ignition timing.

Standard value: 5° BTDC $\pm 3^\circ$

5. Run the engine at idle for 2 minutes.
6. Select No. 22 of the SCAN TOOL DATA LIST.
7. Check the curb idle speed.

Standard value: 750 ± 100 r/min

NOTE

The idle speed is controlled automatically by the idle air control system.

8. If the idle speed is outside the standard value, check the MFI components by referring to GROUP 13A – Troubleshooting.

IDLE MIXTURE CHECK

11100210302

1. Before inspection, set vehicles in the following condition:
 - Engine coolant temperature: $80\text{--}95^\circ\text{C}$ ($176\text{--}203^\circ\text{F}$)
 - Lights, electric cooling fan and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)
2. Turn the ignition switch to OFF and connect the scan tool to the data link connector.
3. Select No. 17 of the SCAN TOOL ACTUATOR TEST.
4. Check that the basic ignition timing is within the standard value.

Standard value: 5° BTDC $\pm 3^\circ$

5. Run the engine.
8. Set the CO, HC tester.
7. Check the CO contents and the HC contents at idle.

Standard value:

CO contents: 0.5% or less

HC contents: 100 ppm or less

8. If the standard value is exceeded, check the following items:
 - Diagnostic output
 - Closed-loop control (When the closed-loop control is carried out normally, the output signal of the heated oxygen sensor repeats between 0–400 mV and 600–1,000 mV at idle.)
 - Fuel pressure
 - Injector
 - Ignition coil, spark plug cable, spark plug
 - EGR system and the EGR valve leak
 - Evaporative emission control system
 - Compression pressure

NOTE

Replace the three-way catalyst whenever the CO and HC contents do not remain inside the standard value. (even though the result of the inspection is normal on all items.)

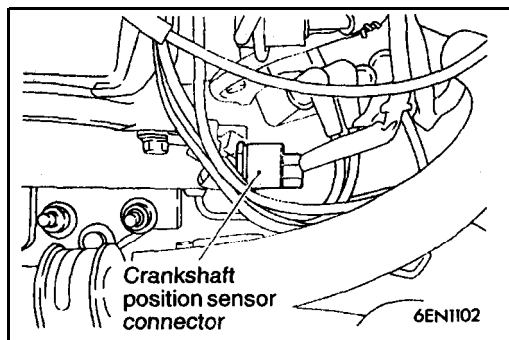
COMPRESSION PRESSURE CHECK

11100260147

1. Before inspection, check that the engine oil, starter and battery are normal. Also, set the vehicle to the following condition:
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lights, electric cooling fan and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)
2. Disconnect the spark plug cables.
3. Remove all of the spark plugs.
4. Disconnect the crankshaft position sensor connector.

NOTE

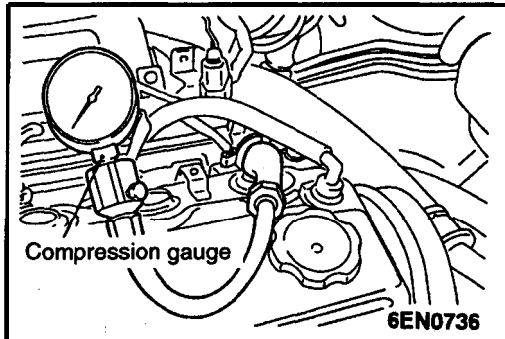
Doing this will prevent the engine control unit from carrying out ignition and fuel injection.



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

Caution

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



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

Standard value (at engine speed of 250–400 r/min):
1,350 kPa (192 psi)

Limit (at engine speed of 250–400 r/min):
Min. 1,020 kPa (145 psi)

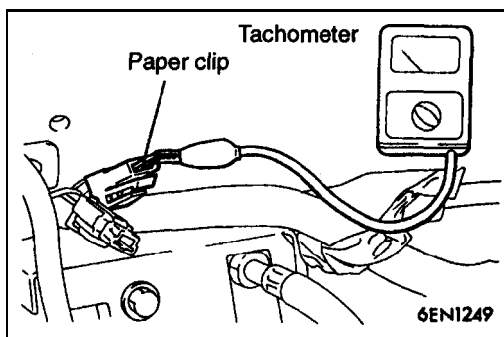
8. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

Limit: Max. 100 kPa (14 psi)

9. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps 7 and 8.
 - (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
 - (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
10. Connect the crankshaft position sensor connector.
11. Install the spark plugs and spark plug cables.
12. Use the scan tool to erase the diagnostic trouble codes, or disconnect the negative battery cable for more than 10 seconds and reconnect it.

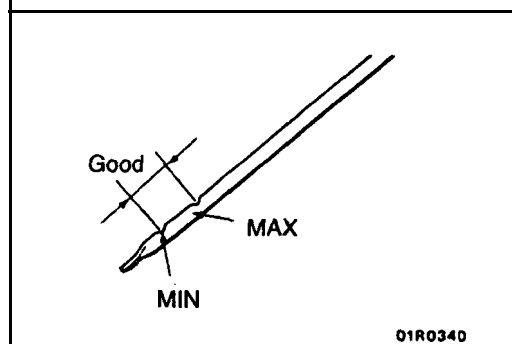
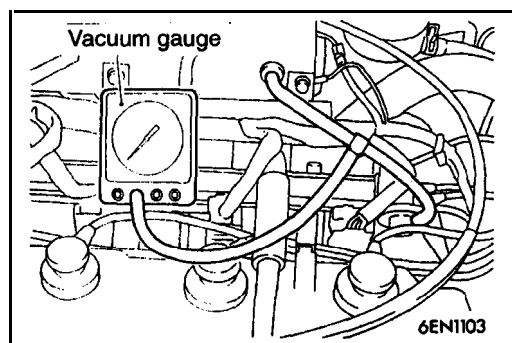
NOTE

This will erase the diagnostic trouble code resulting from the crankshaft position sensor connector being disconnected.

**MANIFOLD VACUUM CHECK**

11100270317

1. Before inspection, set vehicles in the following condition:
 - Engine coolant temperature: 80–95°C (176–203°F)
 - Lights, electric cooling fan, and accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)
2. Set up the tachometer or connect the scan tool to the data link connector.



3. Attach a three-way joint to the vacuum hose connected between the intake manifold plenum and the fuel pressure solenoid valve and connect a vacuum gauge.
4. Start the engine, and check that the curb idle speed is within the standard value range.

Standard value: 750 ± 100 r/min

5. Check the manifold vacuum.

Limit: Min. 60 kPa (16 in.Hg)

LASH ADJUSTER CHECK

11100290252

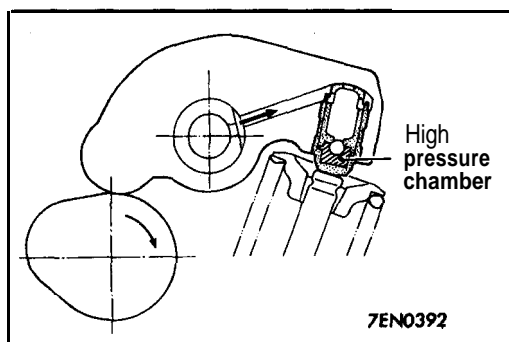
NOTE

If an abnormal noise (rattling noise) probably caused by the lash adjusters is heard and the noise does not **stop**, check as follows.

1. Check the engine oil, and if required, refuel **or replace** it.

NOTE

- If the amount of the engine oil is insufficient, air will be sucked in from the oil strainer and mix in the oil passage.
- If the amount of the engine oil is more **than** the specified amount, it will be stirred by the crankshaft to make a lot of air mix in the oil.
- If the oil is deteriorated, it will not easily **separate** from air and the amount of air mixed in the oil will increase.

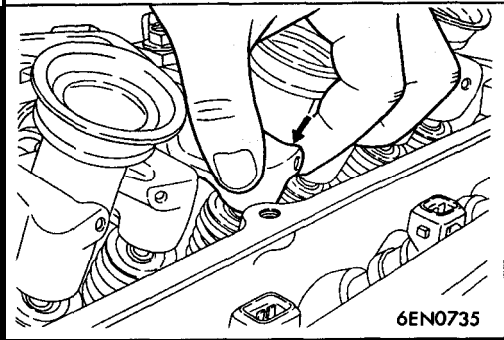
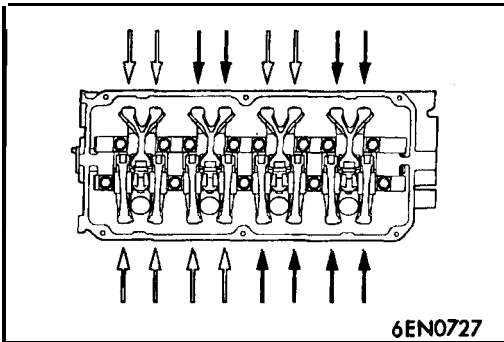


If the air which has mixed in the oil due to the above causes enters the high-pressure chamber in the lash adjusters, the air in the high-pressure chamber will be pressurized during opening of the valve, which causes the lash adjusters to shrink excessively, and an abnormal noise will be generated when the valve is closed. This is the same phenomenon as the one when the valve clearance has been excessively adjusted by mistake. In this case, if the air which has entered the lash adjusters is bled, things will be normalized.

2. Start the engine and perform gentle racing? several times (less than **10** times.)
If the abnormal noise stops by racing, the air is bled from the high pressure chamber of the lash adjusters and the function of the lash adjusters is normalized.
- ① After raising the engine speed from idling to 3,000 **r/min** gradually (in 30 seconds), drop the speed gradually (in 30 seconds) to idling.

NOTE

- If the vehicle is parked on a slope for long, the oil in the lash adjusters will be decreased and air may enter the high-pressure chamber when the vehicle is started.
- After the vehicle is parked for long, air may enter the high-pressure chamber because, the oil in the oil passage will be gone and it will take a time before the oil is supplied to the lash adjusters.



3. If an abnormal noise does not stop by racing, check the lash adjusters according to the following procedures.
 - (1) Stop the engine.
 - (2) Set the No. 1 cylinder of the engine to the compression top dead center.
 - (3) Push the rocker arm indicated by the white arrow mark as shown in the illustration at left and check whether or not the arm lock goes down.
 - (4) Turn slowly the crankshaft 360° clockwise.
 - (5) Check the rocker arm indicated by the black arrow mark as shown in the illustration at left same as above (3).
 - (6) If the rocker arm can be lowered easily when the part of the rocker arm which is directly above the top of the lash adjuster is pressed, the lash adjuster is defective and should be replaced with a new part. Furthermore, when replacing the lash adjuster, bleed all of the air from the lash adjuster and then install. After this, check that there is no problem by checking in steps (1) to (5).

NOTE

- A leak-down test can be carried out to accurately determine whether the lash adjuster is defective or not.
- For the procedures for the leak-down test and air bleeding of the lash adjuster, refer to P. 11 F-32.

Furthermore, if the rocker arm feels extremely stiff and cannot be lowered when it is pressed, the lash adjuster is normal, so investigate for some other cause of the abnormality.

ENGINE ASSEMBLY

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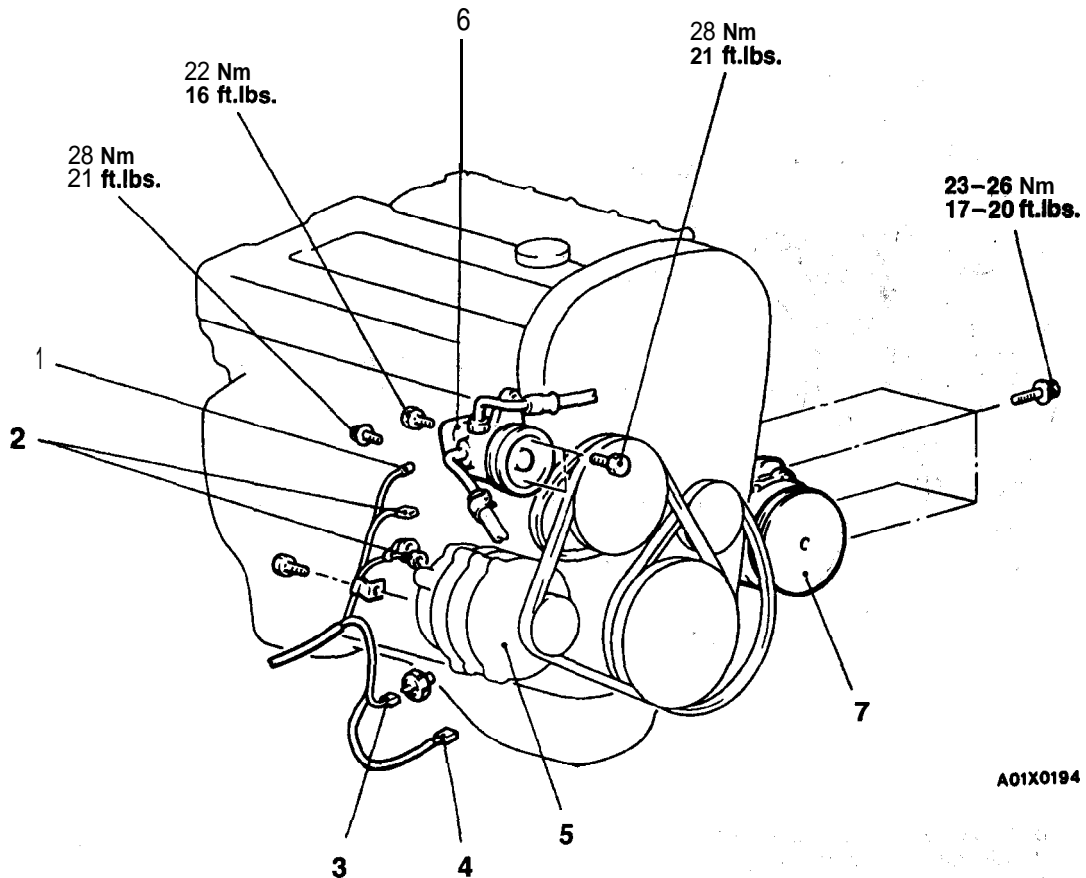
REMOVAL AND INSTALLATION

Pm-removal Operation

- Fuel Line Pressure Releasing
(Refer to GROUP 13A – On-vehicle Service.)
- Hood Removal
- Engine Coolant Draining
(Refer to GROUP 00 – Maintenance Service.)
- Transaxle Assembly Removal
(M/T: Refer to GROUP 22A – Transaxle Assembly.)
(A/T: Refer to GROUP 23A – Transaxle Assembly.)
- Radiator Removal (Refer to GROUP 14 -Radiator.)
- Under Cover Removal
(Refer to GROUP 42 – Under Cover.)

Post-installation Operation

- Radiator Installation
(Refer to GROUP 14 – Radiator.)
- Transaxle Assembly Installation
(M/T: Refer to GROUP 22A – Transaxle Assembly.)
(A/T: Refer to GROUP 23A -Transaxle Assembly.)
- Engine Coolant Supplying
(Refer to GROUP 00 – Maintenance Service.)
- Hood Installation
- Accelerator Cable Adjustment
(Refer to GROUP 17 – On-vehicle Service.)
- Under Cover Installation
(Refer to GROUP 42 – Under Cover.)
- Drive Belt Tension Adjustment
<Power Steering, A/C>



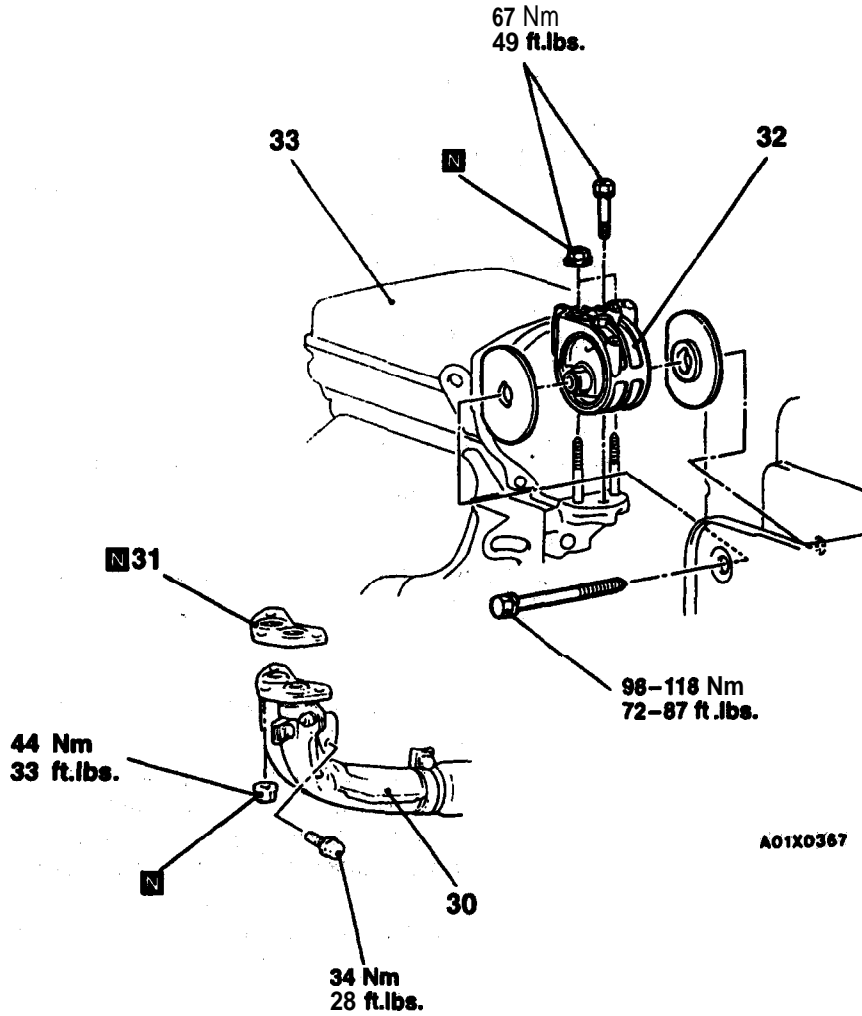
A01X0194

Removal steps

1. Power steering pressure switch connector
2. Generator connectors
3. Oil pressure switch connector
4. Oil pressure gauge unit connector



5. Generator
(Refer to GROUP 16 – Generator.)
6. Power steering pump Connection
7. A/C compressor connection



- 30. Front exhaust pipe connection
- 31. Gasket
- 32. Engine mount bracket assembly
- 33. Engine assembly



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

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

NOTE

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

◀B▶ A/C COMPRESSOR REMOVAL

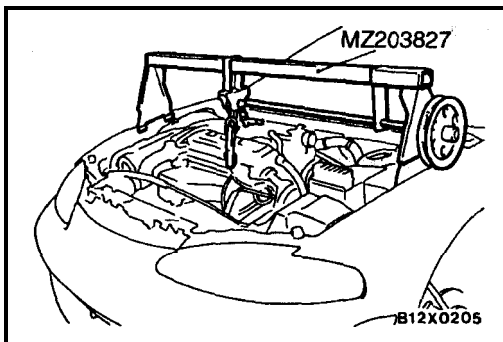
Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE:

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

Caution

Do not bend the joint between the A/C hose and the A/C pipe by force.

**◀C▶ ENGINE MOUNT BRACKET ASSEMBLY REMOVAL**

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

◀D▶ ENGINE ASSEMBLY REMOVAL

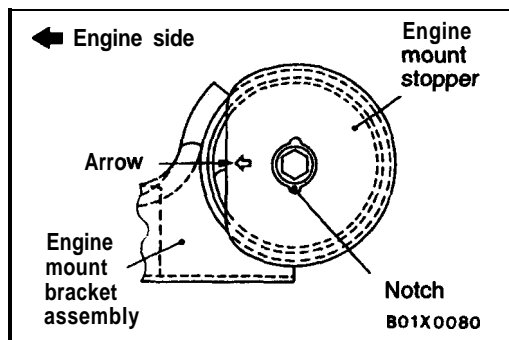
After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

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

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

▶B◀ ENGINE MOUNT BRACKET ASSEMBLY INSTALLATION

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



- (4) Align the notches on the stopper with the engine mount bracket with the arrow mark facing toward the shown direction. Then install the stopper.

▶C◀ HIGH-PRESSURE FUEL HOSE CONNECTION

When connecting the high-pressure fuel hose to the fuel rail, apply a small amount of clean engine oil to the hose union and then insert, being careful not to damage the O-ring.

Caution

Do not let engine oil get into the fuel rail.

CRANKSHAFT PULLEY

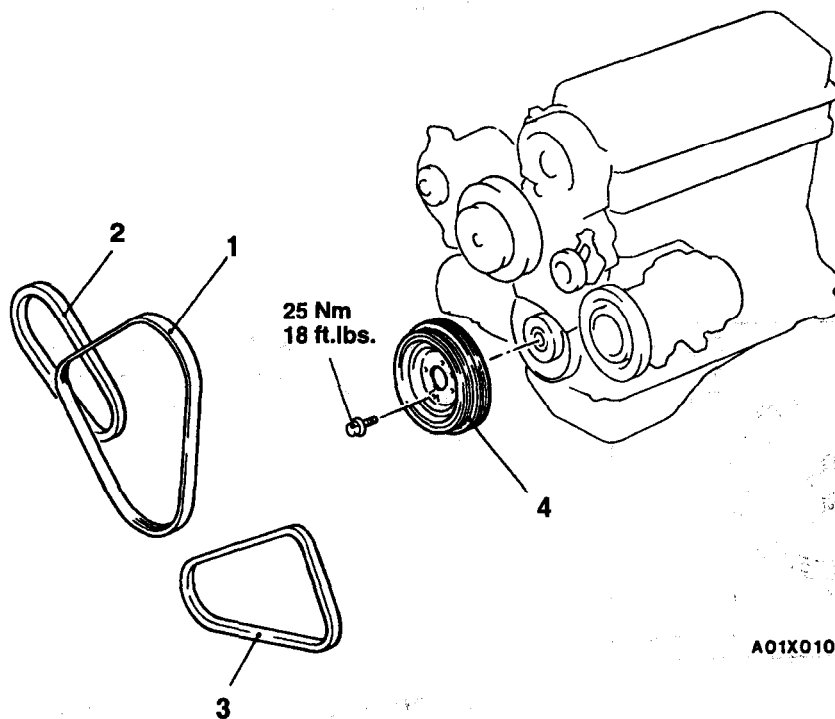
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REMOVAL AND INSTALLATION**Pre-removal' Operation**

- Under Cover Removal
(Refer to GROUP 42 - Under Cover.)

Post-installation Operation

- Drive Belt Tension Adjustment
- Under Cover Installation
(Refer to GROUP 42 - Under Cover.)



A01X0102

Removal steps

1. Drive belt (Generator)
2. Drive belt (Power steering)
3. Drive belt (NC)
4. Crankshaft pulley

CAMSHAFT AND CAMSHAFT OIL SEAL

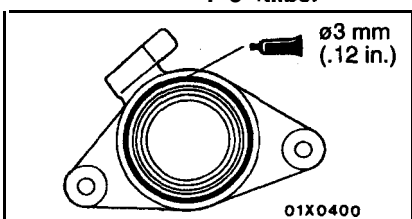
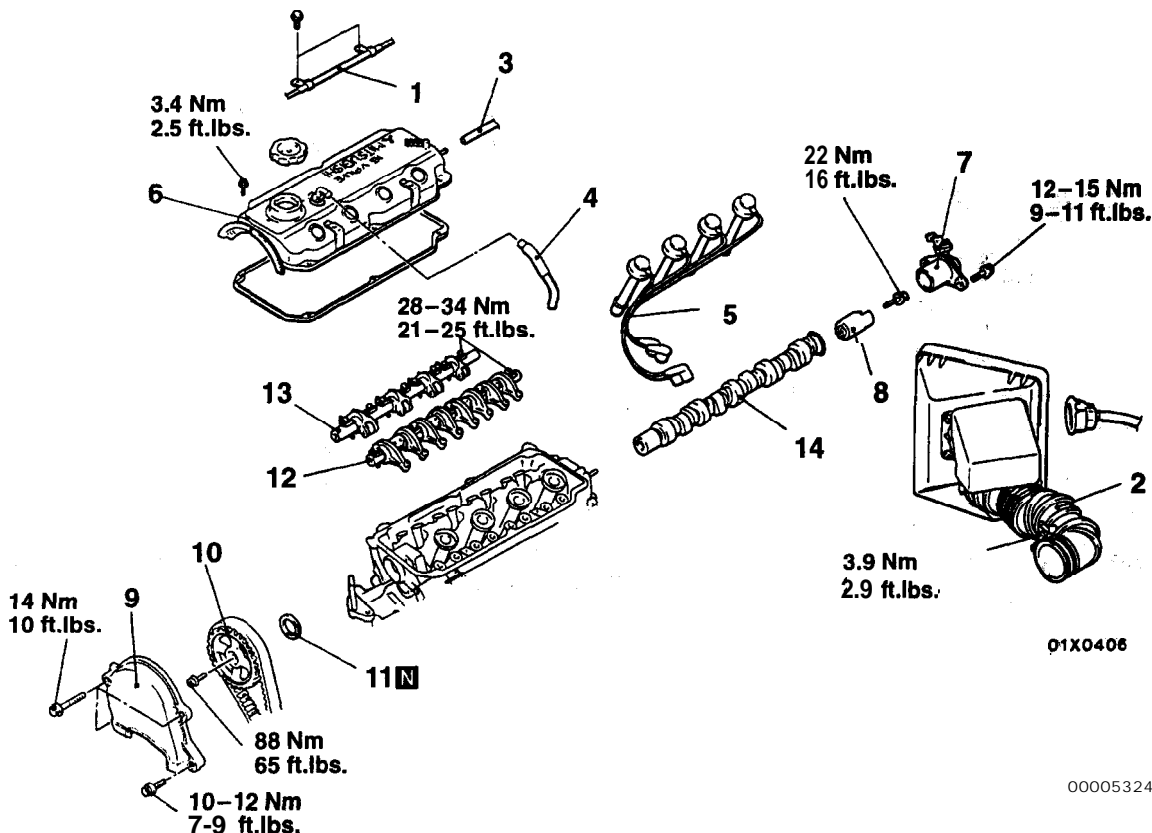
REMOVAL AND INSTALLATION

Pre-removal Operation

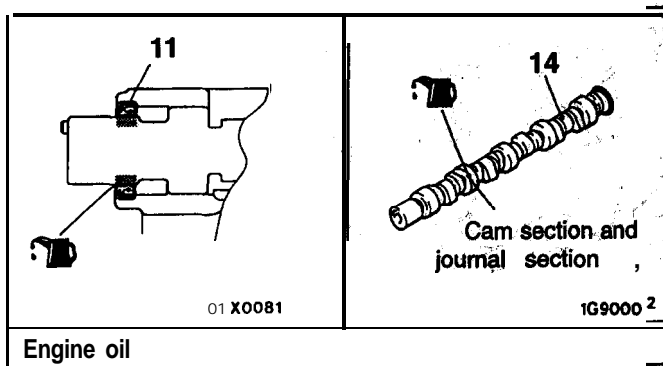
- Battery Removal

Post-installation Operation

- Battery Installation
- Engine Adjustment



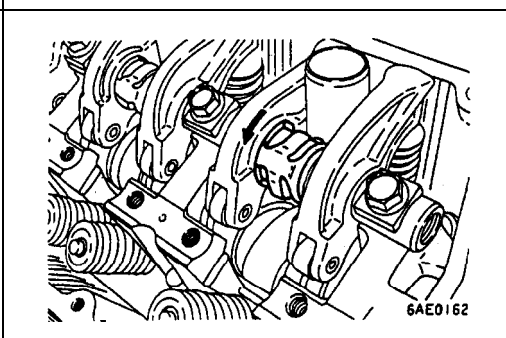
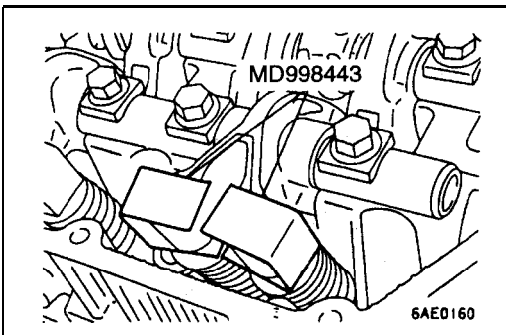
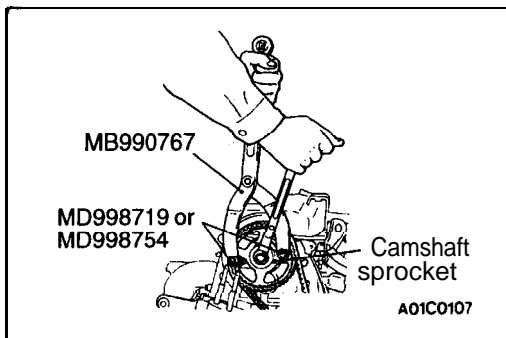
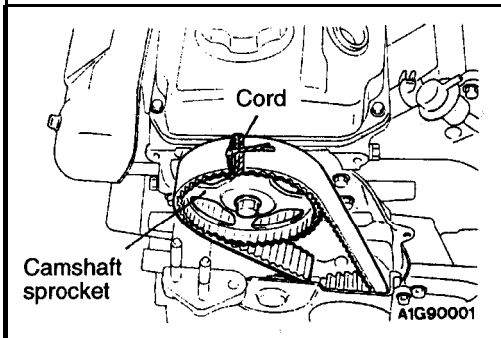
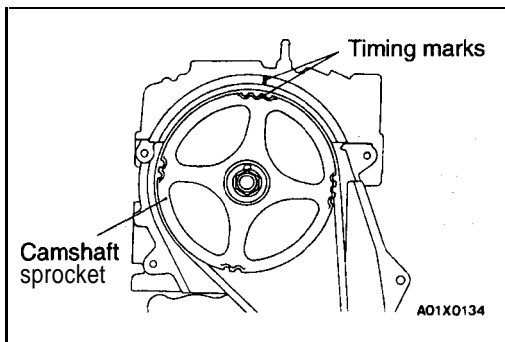
Sealant:
**MITSUBISHI GENUINE PART
 MD970389** or equivalent



Removal steps

1. Accelerator cable connection
2. Air intake nose
3. Connection for breather hose
4. Connection for PCV hose
5. Spark plug cable
6. Rocker cover
7. Camshaft position sensor support
8. Camshaft position sensing cylinder

9. Timing belt upper cover
10. Camshaft sprocket
11. Camshaft oil seal
12. Rocker arm and shaft assembly (Intake side)
13. Rocker arm and shaft assembly (Exhaust side)
14. Camshaft



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

- (1) Rotate the crankshaft in the **forward** (right) direction and align the timing marks. (No.1 cylinder is the compression stroke top dead center position.)

Caution

The crankshaft must always be rotated in the **forward** direction only.

- (2) Tie the camshaft sprocket and timing belt with a cord so that the position of the camshaft sprocket will not move with respect to the timing belt.

- (3) Use the special tool to remove the camshaft sprocket with the timing belt attached.

Caution

After removing the camshaft sprocket, be sure **not** to rotate the crankshaft.

◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

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

INSTALLATION SERVICE POINTS

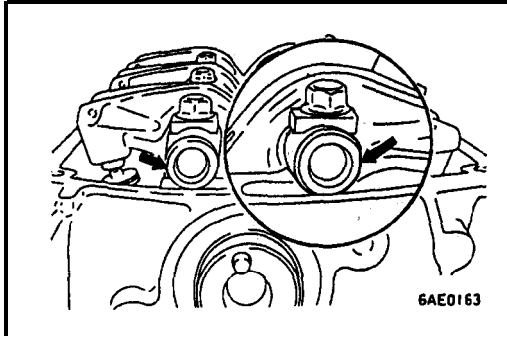
▶A▶ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

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

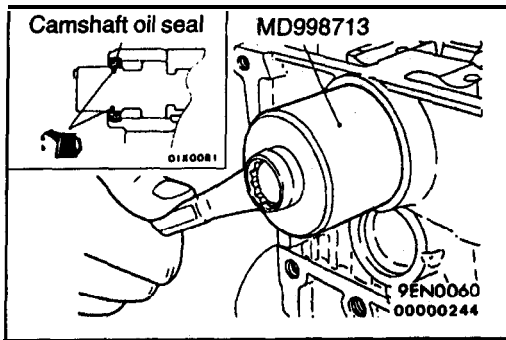
NOTE

Install the rocker shaft spring **before** installing the rocker arm and rocker arm shaft on the exhaust side.

- (3) Remove the special tool for fixing the lash adjuster.

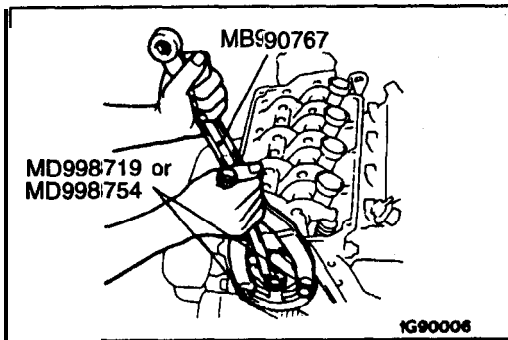


- (4) Confirm that the rocker shaft notch is in the direction shown in the diagram.



►B◄ CAMSHAFT OIL SEAL INSTALLATION

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



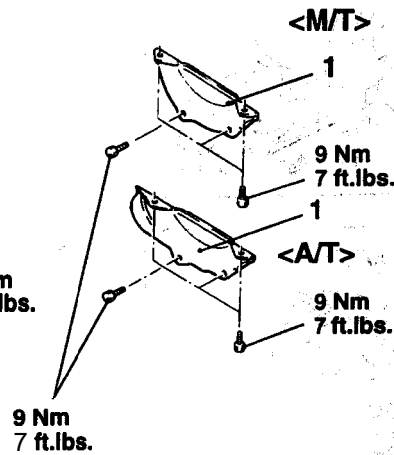
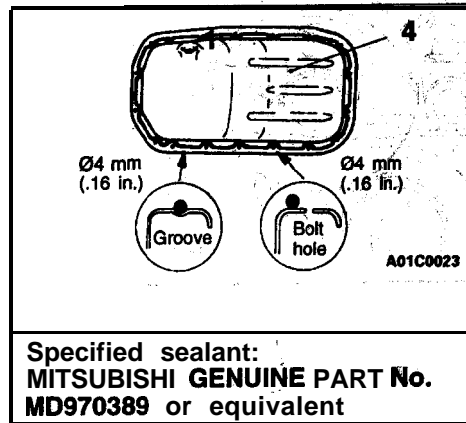
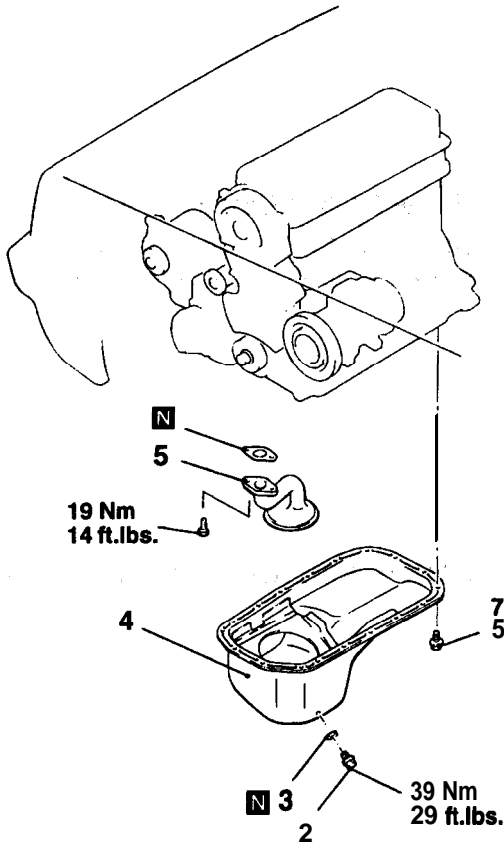
►C◄ CAMSHAFT SPROCKET INSTALLATION

OIL PAN AND OIL SCREEN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Oil Draining and Supplying
(Refer to GROUP 00 – Maintenance service.)
- Oil Level Gauge Removal and Installation
- Front Exhaust Pipe Removal and Installation
(Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)



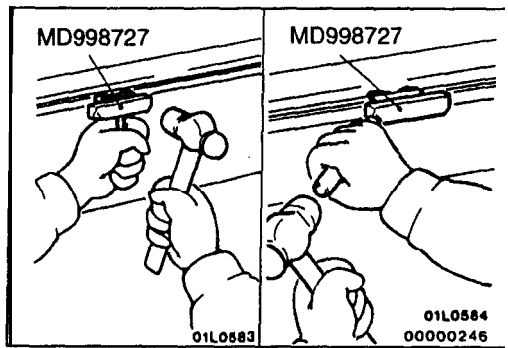
01X0188

00000245

Removal steps

1. Bell housing cover
2. Drain plug
3. Gasket
4. Oil pan
5. Oil screen



**REMOVAL SERVICE POINT****◀A▶ OIL PAN REMOVAL**

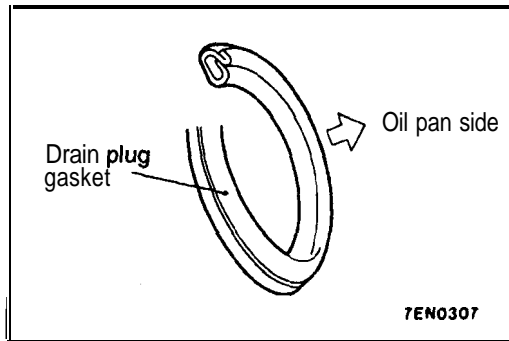
After removing the oil pan **mounting bolts**, remove the oil pan with the special tool and a brass **bar**.

Caution

Do it slowly to avoid deformation of **the oil pan flange**.

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

After cleaning the oil pan **mounting bolt holes in the oil seal case**, the oil pan should be **installed**.

**▶B◀ GASKET INSTALLATION**

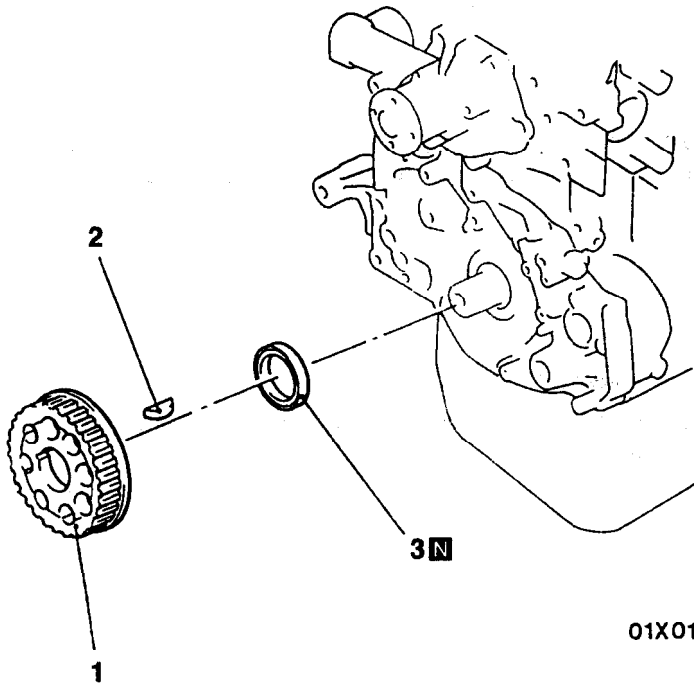
Replace the gasket and install it in the **direction shown** in the illustration.

CRANKSHAFT FRONT OIL SEAL

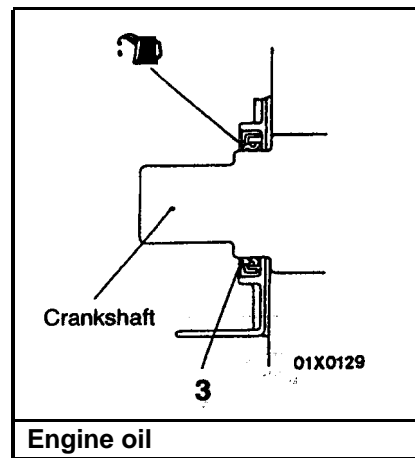
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Timing Belt B Removal and Installation
(Refer to P.11E-41.)



01X0193



00003917

Removal steps

1. Crankshaft sprocket B
2. Key
- ▶◀ 3. Crankshaft front oil seal

INSTALLATION SERVICE POINT

▶◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

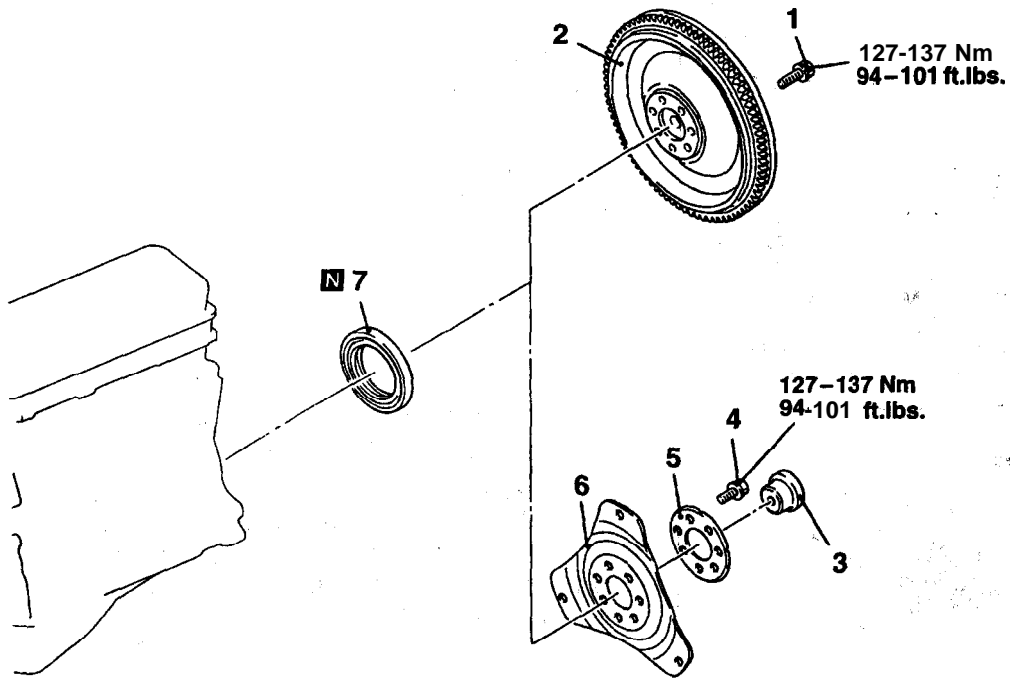
- (1) Apply engine oil to the entire inside diameter of the oil seal lip.
- (2) Press-fit the oil seal until it is flush with the oil pump case.

CRANKSHAFT REAR OIL SEAL

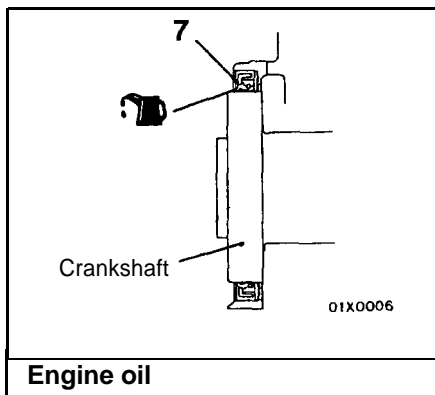
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REMOVAL AND INSTALLATION

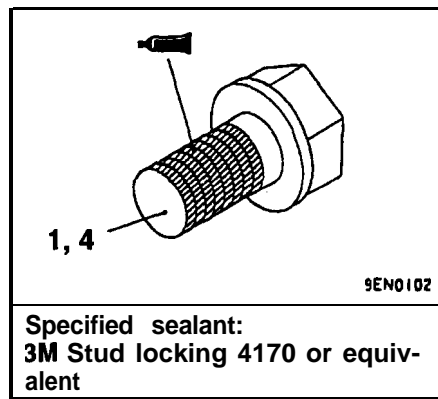
- Pre-removal and Post-installation Operation**
- **Transaxle** Assembly Removal and Installation
(M/T: Refer to GROUP 22A–Transaxle Assembly.)
(A/T: Refer to GROUP 23A–Transaxle Assembly.)
 - Clutch Cover and Clutch Disc Removal and Installation <M/T>



01X0094
00004206



Engine oil

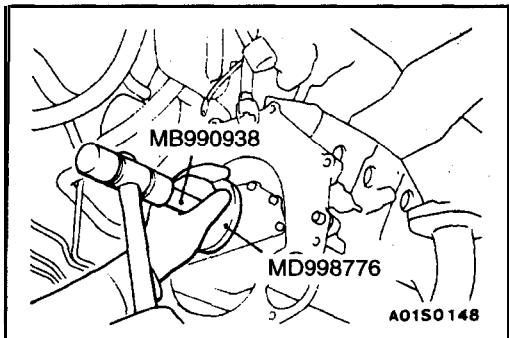


Specified sealant:
3M Stud locking 4170 or equivalent

Removal steps

- ◀A▶ ▶B◀ 1. Flywheel bolt <M/T>
- 2. Flywheel <M/T>
- 3. Crankshaft bushing <A/T>
- ◀A▶ ▶B◀ 4. Drive plate bolt <A/T>

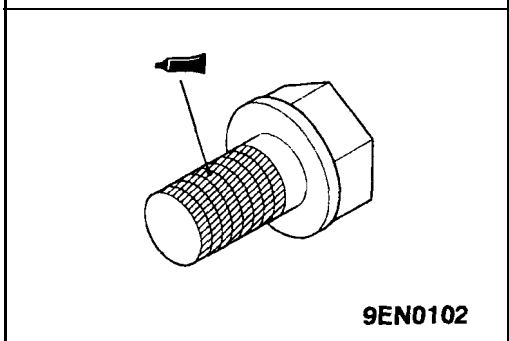
- 5. Adapter plate <A/T>
- 6. Drive plate <A/T>
- ▶A◀ 7. Crankshaft rear oil seal



INSTALLATION SERVICE POINTS

►A◄ CRANKSHAFT REAR OIL SEAL INSTALLATION

- (1) Apply a small amount of engine oil to the entire inside diameter of the oil seal lip.
- (2) Tap in the oil seal as shown in the illustration.

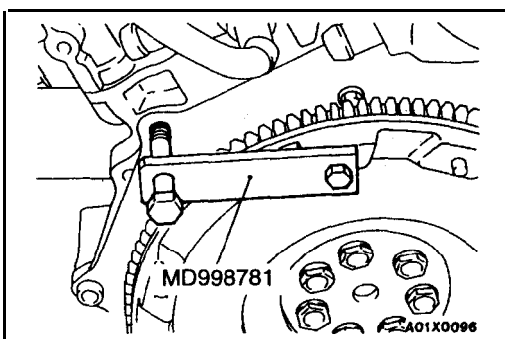


►B◄ DRIVE PLATE BOLT <A/T>/FLYWHEEL BOLT <M/T> INSTALLATION

- (1) Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel <M/T> or drive plate <A/T>.
- (2) Apply oil to the bearing surface of the flywheel <M/T> or drive plate <A/T> bolt.
- (3) Apply oil to the crankshaft thread holes.
- (4) Apply sealant to the threaded mounting bolts.

Specified sealant:

3M Stud locking 4170 or equivalent



- (5) Use the special tool to secure the **flywheel <M/T>** or drive plate <A/T>, and then tighten the bolts to the specified torque.

Specified torque:

127-137 Nm (94-101 ft.lbs.)

CYLINDER HEAD GASKET

11200400412

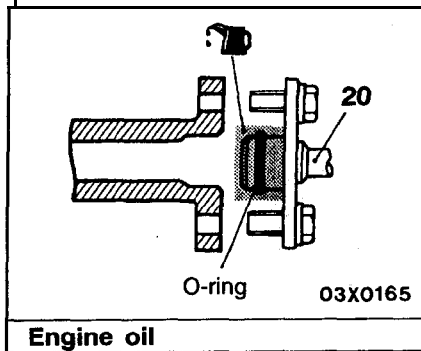
REMOVAL AND INSTALLATION

Pre-removal Operation

- Fuel Line Inner Pressure Release (Refer to GROUP 13A – On-vehicle Service.)
- Engine Coolant Draining (Refer to GROUP 00 – Maintenance Service.)
- Engine Oil Draining (Refer to GROUP 00 – Maintenance Service.)

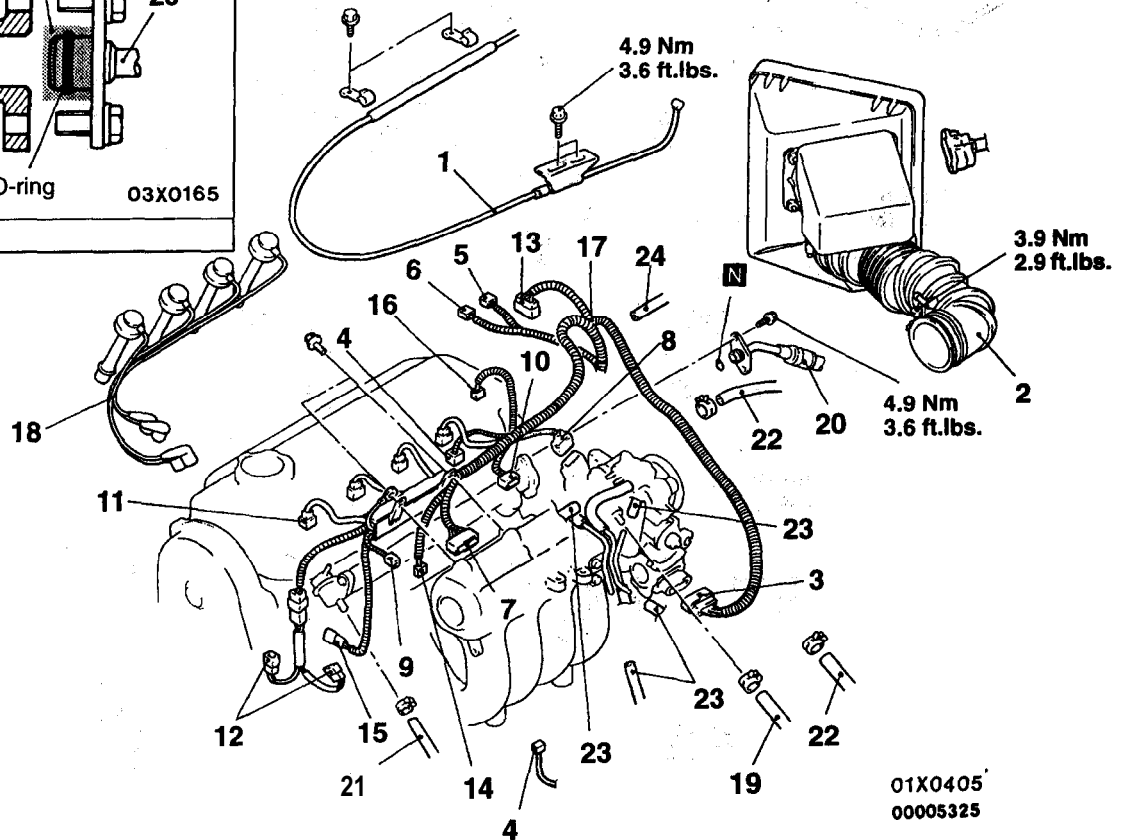
Post-installation Operation

- Engine Oil Refilling (Refer to GROUP 00 – Maintenance Service.)
- Engine Coolant Refilling (Refer to GROUP 00 – Maintenance Service.)



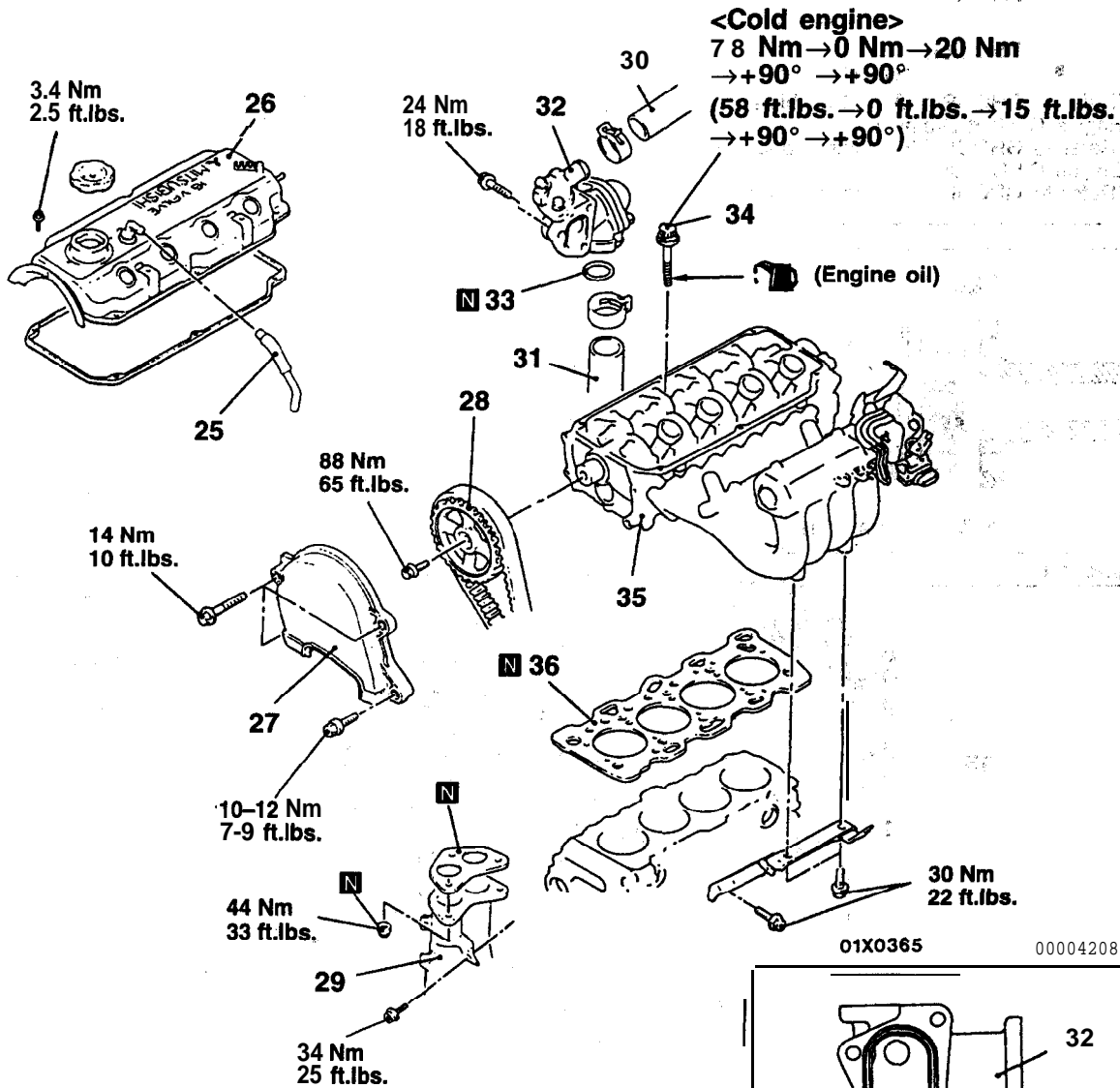
O-ring 03X0165

Engine oil

01X0405
00005325

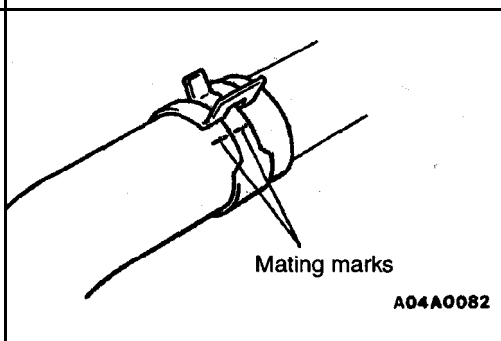
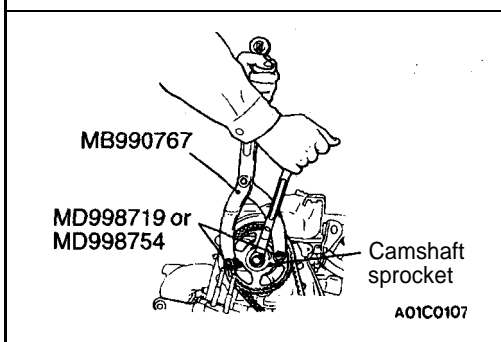
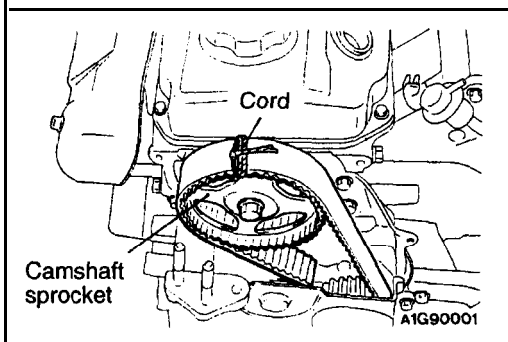
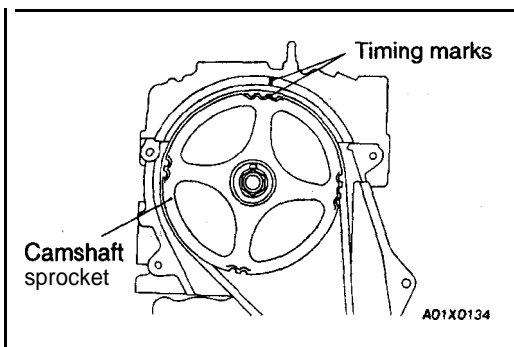
Removal steps

1. Accelerator cable connection (Refer to GROUP 17–On-vehicle Service.)
2. Air intake hose
3. Idle air control motor connector
4. Heated oxygen sensor connector
5. Engine coolant temperature gauge unit connector
6. Engine coolant temperature sensor connector
7. Ignition power transistor connector
8. Throttle position sensor connector
9. Capacitor connector
10. Manifold differential pressure sensor connector
11. Injector connectors
12. Ignition coil connector
13. Camshaft position sensor connector
14. Crankshaft position sensor connector
15. Air conditioning compressor connector
16. Evaporative emission purge solenoid valve connector
17. Control wiring harness
18. Spark plug cable
19. Brake booster vacuum hose connection
- ▶F◀ 20. High-pressure fuel hose connection
21. Fuel return hose connection
22. Water hose connection
23. Vacuum hoses connection
24. Breather hose connection



- 25. PCV hose
- 26. Rocker cover
- 27. Timing belt upper cover
- 28. Camshaft sprocket
- 29. Front exhaust pipe connection
- 30. Radiator upper hose connection

- 31. Radiator lower hose connection
- 32. Thermostat case assembly
- 33. O-ring
- 34. Cylinder head bolt
- 35. Cylinder head assembly
- 36. Cylinder head gasket



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

- (1) Rotate the crankshaft in the forward (right) **direction** and, align the timing marks. (No.1 cylinder is the **compression** stroke top dead **center** position.)

Caution

The crankshaft must always be **rotated** in the **forward** direction only.

- (2) Tie the camshaft sprocket and timing belt with a cord so that the position of the camshaft sprocket **will not move** with respect to the timing belt.

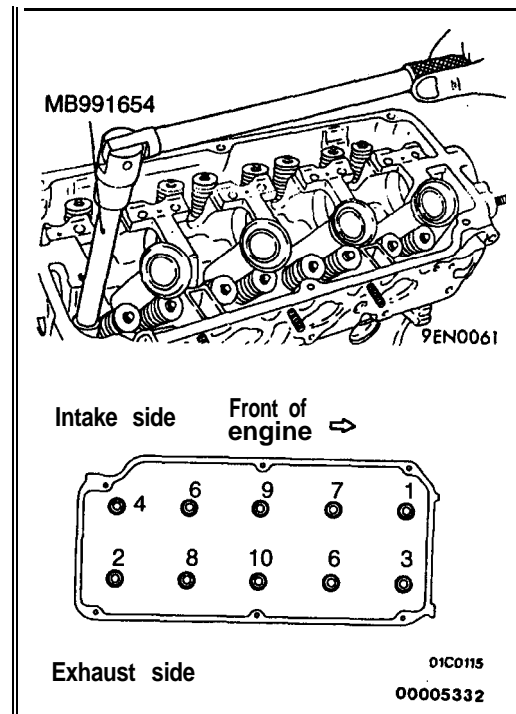
- (3). Use the special tool to remove the **camshaft** sprocket with the timing belt attached.

Caution

After removing the **camshaft sprocket**, be sure not to **rotate** the crankshaft.

◀B▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

Place mating marks on the radiator hose and **the hose** clamp, and then disconnect the radiator hose.

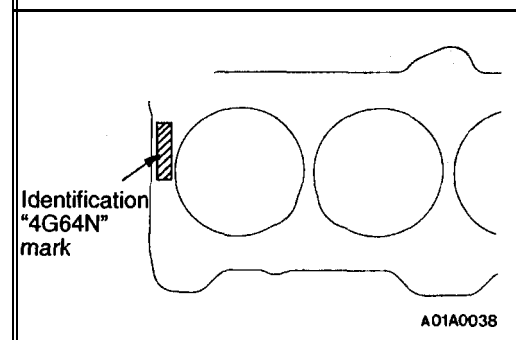


◀C▶ CYLINDER HEAD BOLT REMOVAL

Using the special tool, loosen the bolts in the order shown in the illustration (in 2 or 3 stages), and then remove the cylinder head assembly.

Caution

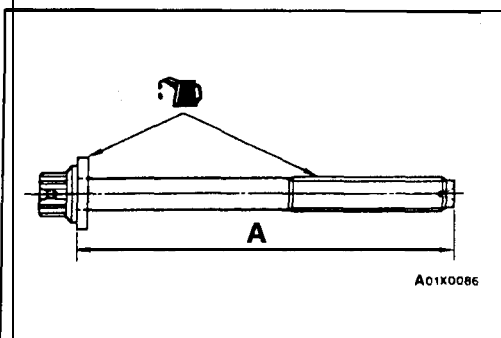
Because the plug guides cannot be replaced by themselves, be careful not to damage or deform the plug guides when removing the cylinder head bolts.



INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

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

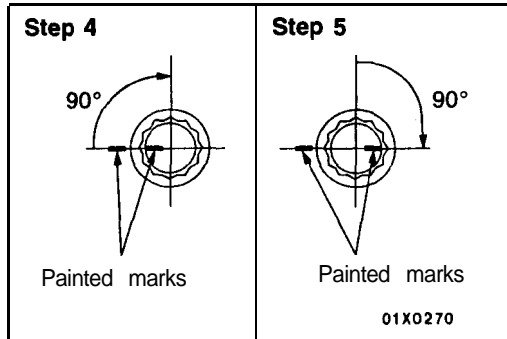
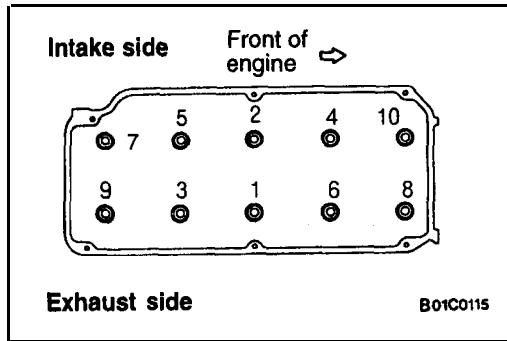


▶B◀ CYLINDER HEAD BOLT INSTALLATION

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

Limit (A): 99.4 mm (3.91 in.)

- (2) Apply engine oil to the bolt thread and the washer.

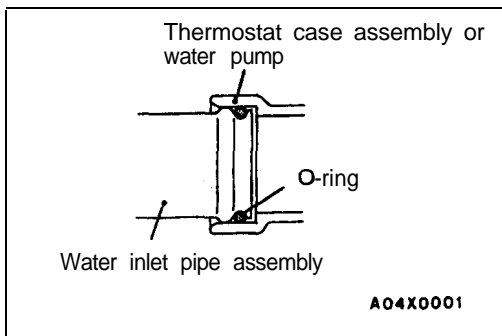


(3) Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 78 Nm (58 ft.lbs.).	In the order shown in the illustration.
2	Loosen fully.	In the reverse order of that shown in the illustration.
3	Tighten to 20 Nm (15 ft.lbs.).	In the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
5	Tighten 90° of a turn.	In the order shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

Caution

1. Always make a tightening angle just 90°. If it is less than 90°, the head bolt will be loosened.
2. If it is more than 90°, remove the head bolt and repeat the procedure from step 1.

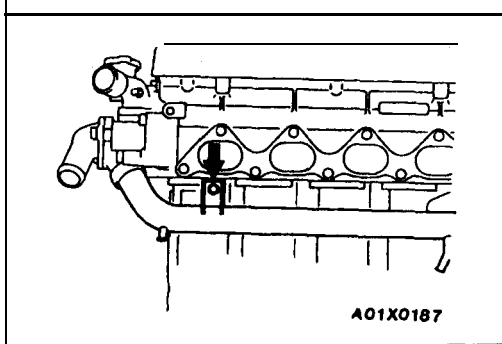


▶◀ **O-RING INSTALLATION**

Insert the O-ring to the water inlet pipe, and coat the outer inside diameter of the O-ring with water or engine coolant.

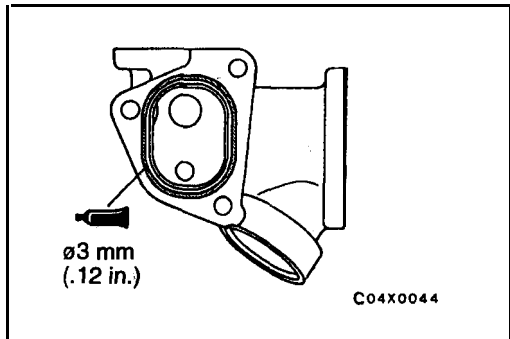
Caution

Do not let engine oil or other greases contact with the O-ring.



▶◀ **THERMOSTAT CASE ASSEMBLY INSTALLATION**

- (1) Loosen the water inlet pipe bolt shown in the illustration.



- (2) Apply specified sealant to the thermostat case assembly in the places shown in the illustration.

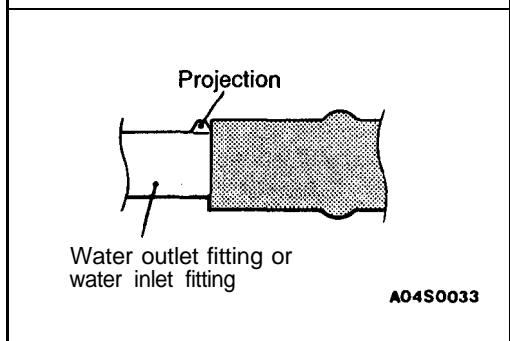
Specified sealant:

MITSUBISHI GENUINE PART MD970389 or equivalent

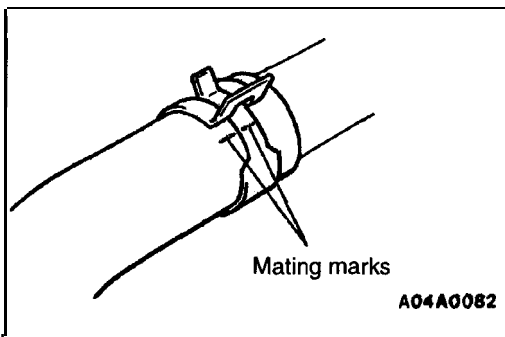
- (3) Apply a small amount of **water** to the O-ring of the water inlet pipe, and then press the thermostat case assembly into the water inlet pipe.
- (4) Tighten the thermostat case assembly mounting, bolts.
- (5) Tighten the water inlet pipe bolts.

►E◄ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

- (1) Insert each hose as far as the projection of the water outlet fitting or water inlet fitting.



- (2) Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.



►F◄ HIGH-PRESSURE FUEL HOSE CONNECTION

When connecting the high-pressure fuel hose to the fuel rail, apply a small amount of clean engine oil to the hose union and then insert, being careful not to damage the O-ring.

Caution

Do not let engine oil get into the fuel rail.

TIMING BELT

11200430220

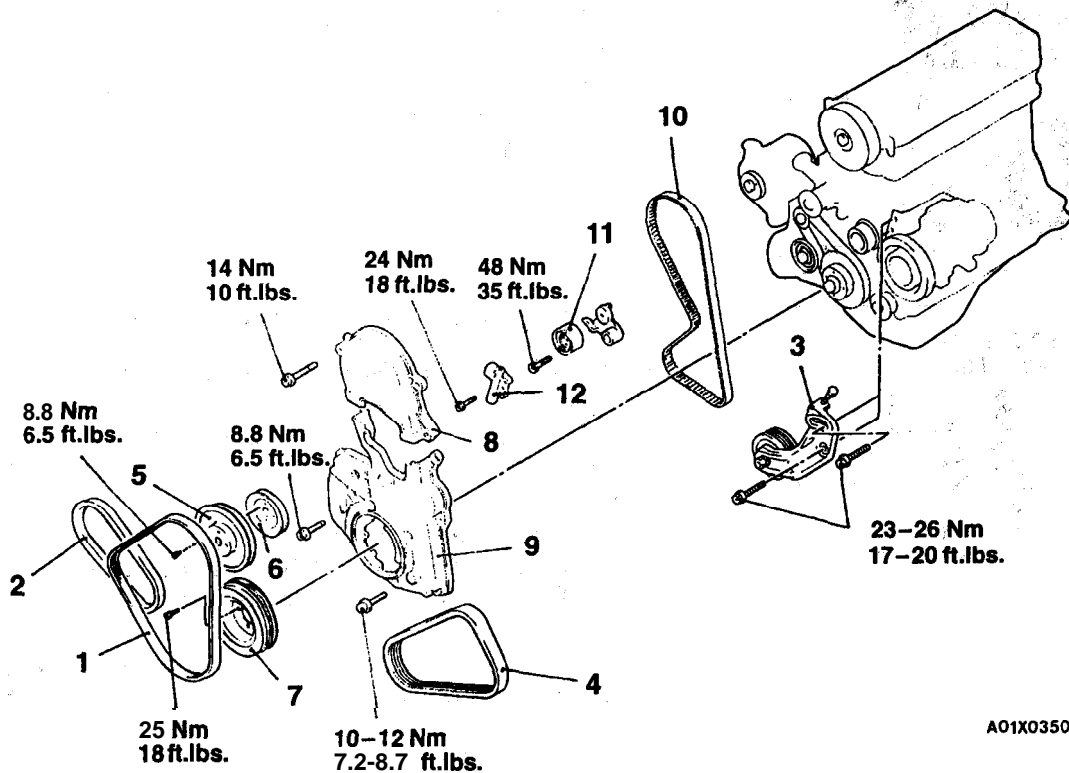
REMOVAL AND INSTALLATION

Pre-removal Operation

- Under Cover Removal
(Refer to GROUP 42 - Under Cover.)
- Engine Mount Bracket Removal
(Refer to GROUP 32 - Engine Mounting.)

Post-installation Operation

- Under Cover Installation
(Refer to GROUP 42 - Under Cover.)
- Engine Adjustment
- Engine Mount Bracket **Installation**
(Refer to GROUP 32 - Engine Mounting.)

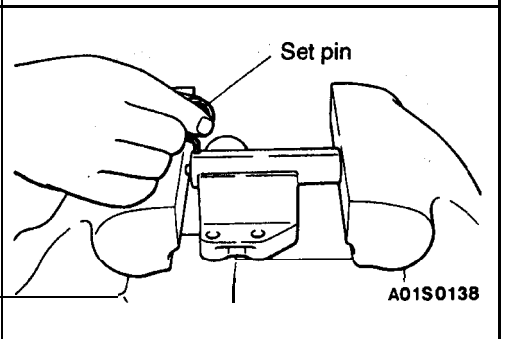
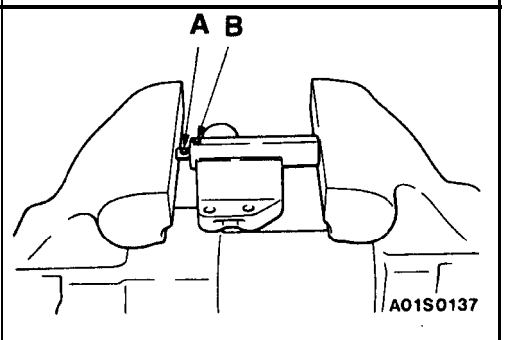
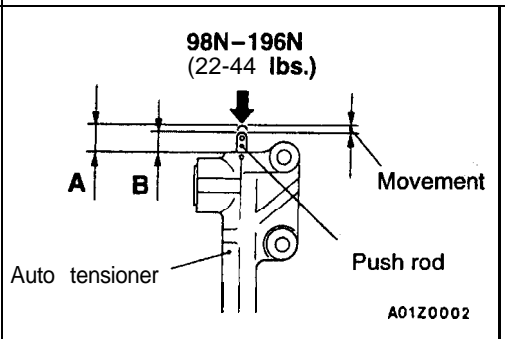
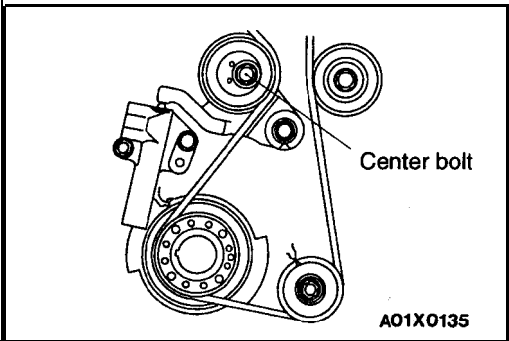
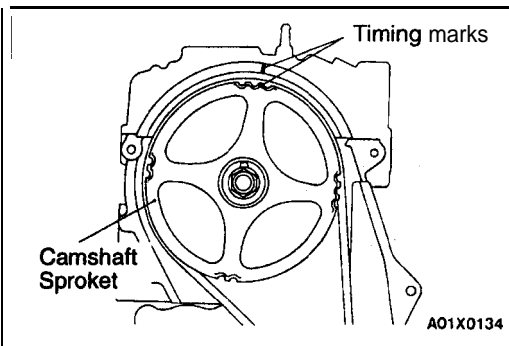


A01X0350

Removal steps

- Drive Belt Tension Adjustment
- 1. Drive belt (Generator)
- 2. Drive belt (Power steering)
- 3. Tensioner pulley bracket
- 4. Drive belt (A/C)
- 5. Water pump pulley
- 6. Water pump pulley (Power steering)

- 7. Crankshaft pulley
- 8. Timing belt front upper cover
- 9. Timing belt front lower cover
- timing belt tension adjustment
- 10. Timing belt
- 11. Tension pulley
- 12. Auto tensioner



REMOVAL SERVICE POINT

◀A▶ TIMING BELT, REMOVAL

- (1) Turn the crankshaft in the forward direction (to the **right**) to align the camshaft sprocket timing marks.

Caution
Always turn the crankshaft in the **forward direction** only.

- (2) Loosen the tension pulley center bolt.
- (3) Move the tension pulley to the water pump side, and then remove the timing belt.

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

INSTALLATION SERVICE POINTS

▶A◀ AUTO TENSIONER INSTALLATION

- (1) Apply 98-196 N (22-44 lbs.) force to the push rod of the auto tensioner by **pressing** it against a metal (cylinder block,..etc.), and measure the movement of the push rod.

Standard value: Within 1 mm (.04 in.)

- A:** Length when it is free (not pressed)
- B:** Length when it is **pressed**
- A-B:** Movement

- (2) If it is out of the standard value, replace the auto tensioner.
- (3) Use a press or vise to gently compress the auto tensioner push rod until pin hole A of the push rod and pin hole B of the tensioner cylinder are aligned.

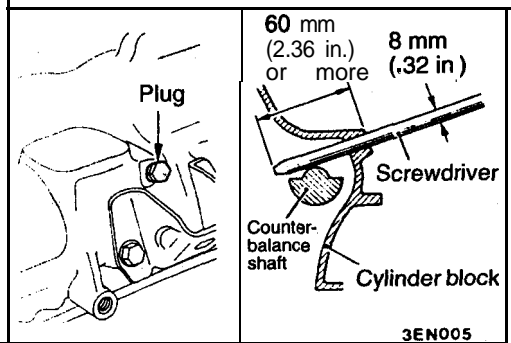
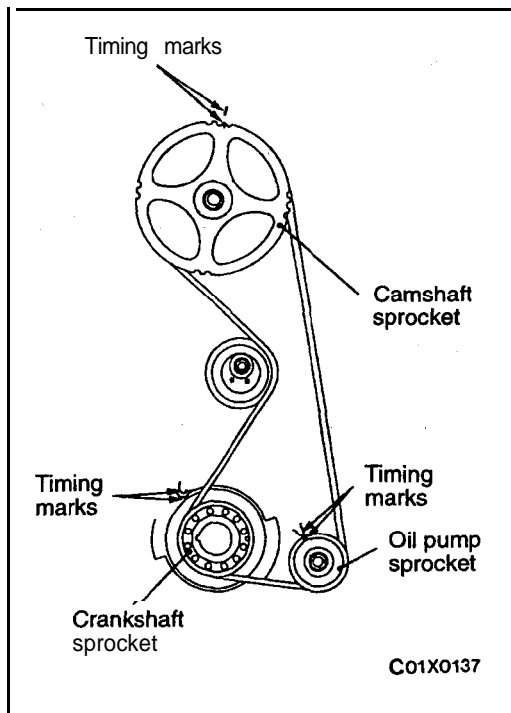
Caution
If the compression **speed is too fast**, the rod may become damaged, so be sure to carry out this operation slowly.

- (4) Once the holes are aligned, insert the set pin.

NOTE

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

- (5) Install the auto tensioner to the **engine**.



►B◀ TIMING BELT INSTALLATION

- (1) Align the timing marks on the camshaft sprocket; crankshaft sprocket and oil pump sprocket.

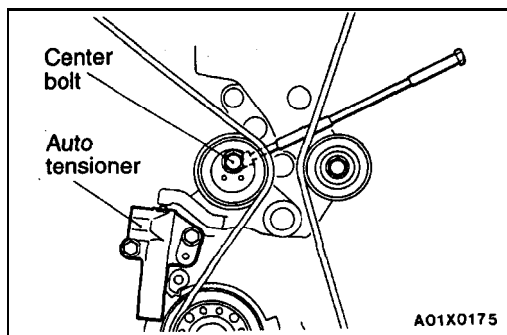
- (2) After aligning the timing mark on the oil pump sprocket, remove the cylinder block plug and insert a Phillips screwdriver with a diameter of 8 mm (.32 in.), and check to be sure that the screwdriver goes in 60 mm (2.36 in.) or more. If the screwdriver will only go in 20 – 25 mm (.79 – .98 in.) before striking the counterbalance shaft, turn the sprocket once, realign the timing mark and check that the screwdriver goes in 60 mm (2.36 in.) or more. Do not take out the screwdriver until the timing belt is installed.

- (3) Install the timing belt so as not to be loosened among the sprockets, by the following procedure.

Caution

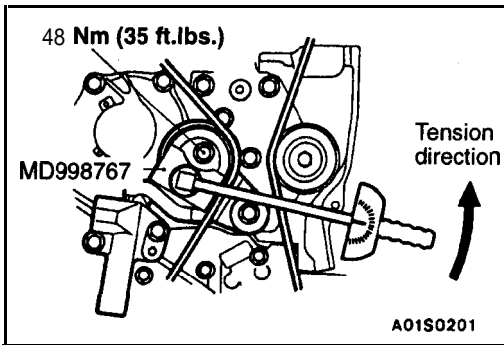
If the timing belt is to be reused, install it so that the mark indicates the clockwise direction.

- (4) Set the tension pulley so that the pin holes are at the bottom, press the tension pulley lightly against the timing belt.



- (5) Screw the tool into the engine left support bracket until its end makes contact with the tensioner arm. At that point, screw the tool in some more and then remove the set wire attached to the auto tensioner.
- (6) Remove the tool.
- (7) Tighten the center bolt to the specified torque.

Specified torque: 48 Nm (35 ft.lbs.)



►C◄ **TIMING BELT TENSION ADJUSTMENT**

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

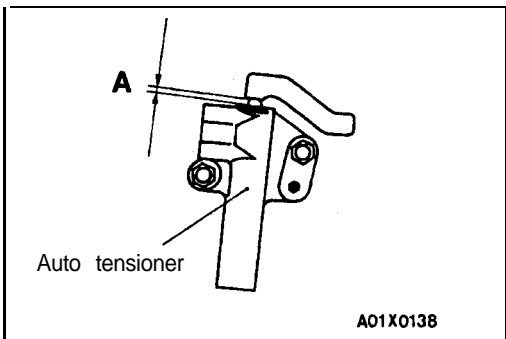
Standard value:

3.5 Nm (2.6 ft.lbs.)

<Timing belt tension torque> ,

Caution

When tightening the fixing bolt, do not let the tension pulley turn with the bolt.



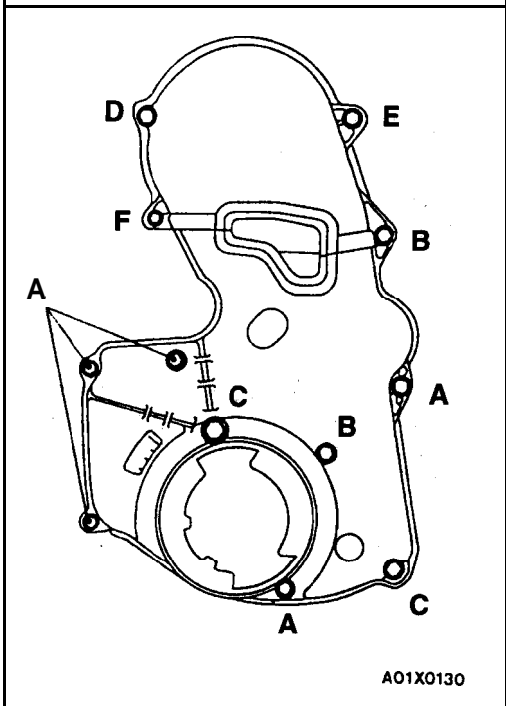
- (3) Turn the crankshaft two revolutions 'clockwise so that the timing marks are aligned. **After** leaving it for 15 minutes, measure the amount of protrusion of the auto tensioner.

Standard value (A): 3.8-4.5 mm (.150-.177 in.)

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

►D◄ **TIMING BELT FRONT LOWER COVER/TIMING BELT FRONT UPPER COVER INSTALLATION**

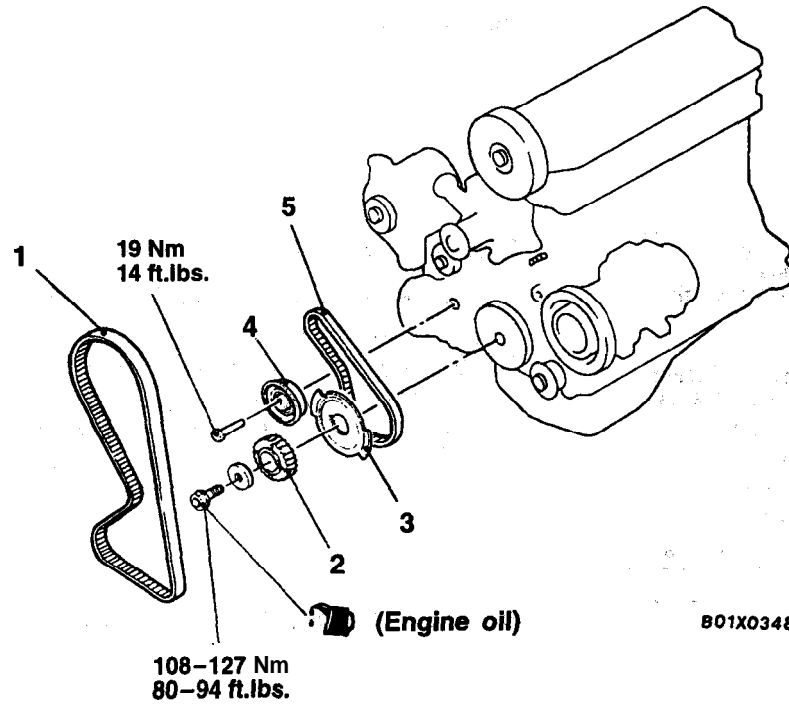
Install the bolts, being careful not to mistake the bolt size!s.



	Thread diameter × thread length mm (in.)	Bolt classification	Tightening torque Nm (ft.lbs.)
A	6 × 18 (.24 × .71)	Flange bolt	10-12 (7.2-8.7)
B	6 × 25 (.24 × .98)	Flange bolt	10-12 (7.2-8.7)
C	6 × 25 (.24 × .98)	Washer assembled bolt	8.8 (6.5)
D	8 × 50 (.31 × 1.97)	Flange bolt	14 (10)
E	8 × 28 (.31 × 1.10)	Flange bolt	14 (10)
F	8 × 35 (.31 × 1.38)	Flange bolt	14 (10)

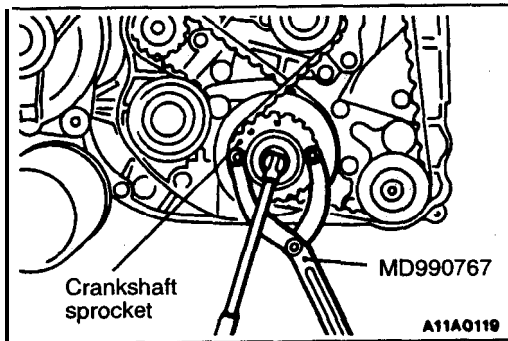
TIMING BELT B

REMOVAL AND INSTALLATION



Removal steps

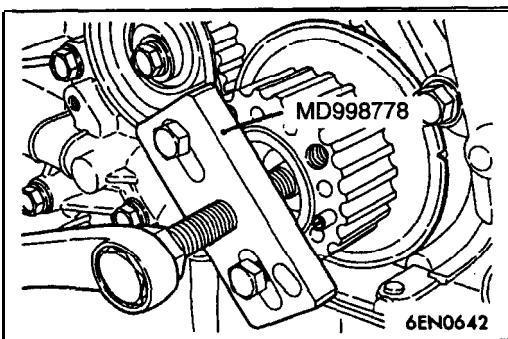
- 1. Timing belt (Refer to P.11 E-35.)
- ◀A▶ ▶D▶ 2. Crankshaft sprocket
- ▶C▶ 3. Crankshaft sensing blade
- ▶B▶ • Timing belt B tension adjustment
- 4. Timing belt B tensioner
- ▶B▶ ▶A▶ 5. Timing belt B



REMOVAL SERVICE POINTS

◀A▶ CRANKSHAFT SPROCKET REMOVAL

(1) Use the special tool to remove the bolt.

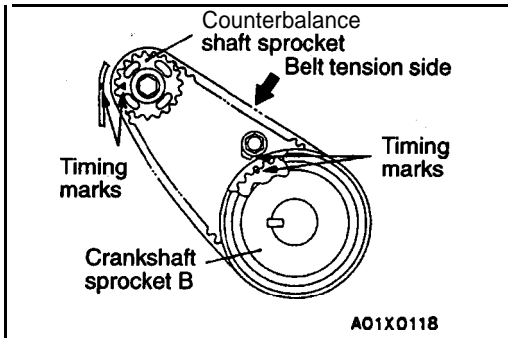


(2) Use the special tool to remove the crankshaft sprocket.

◀B▶ TIMING BELT B REMOVAL,,

Caution

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

**INSTALLATION SERVICE POINTS**

▶A▶ TIMING BELT B INSTALLATION

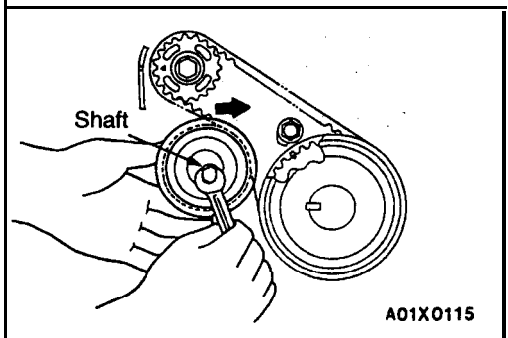
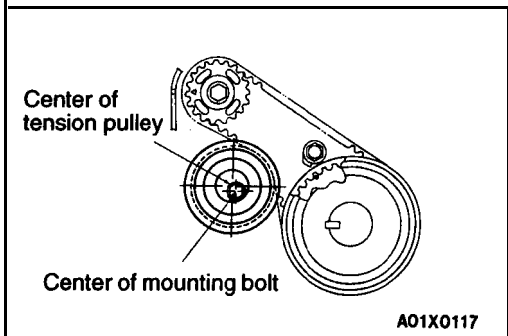
Install timing belt "B" by the following procedure.

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

▶B▶ TIMING BELT B TENSION ADJUSTMENT

Adjust the tension of timing belt "B" by the following procedure.

- (1) Temporarily fix the timing belt "B" tensioner such that the center of the tensioner pulley is to the left and above the center of the installation bolt, and temporarily attach the tensioner pulley so that the flange is toward the front of the engine.



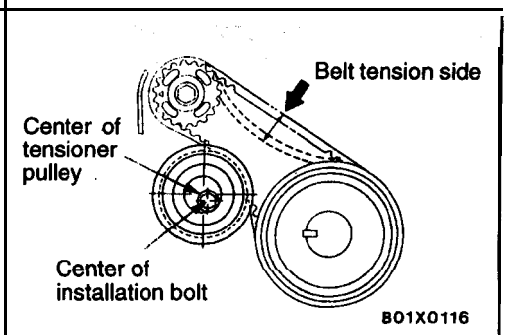
- (2) Holding the timing belt "B" tensioner up with your **finger** in the direction of the **arrow**, **place pressure on the timing belt** so that the tension side of the belt is taut. Now tighten the bolt to fix the tensioner.

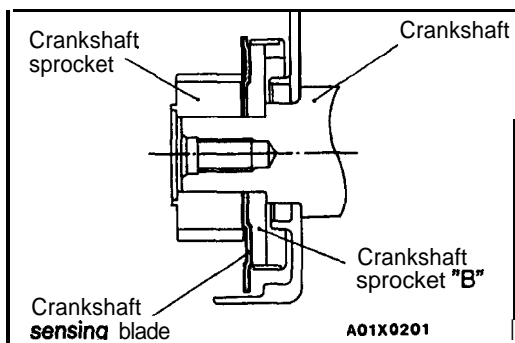
Caution

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

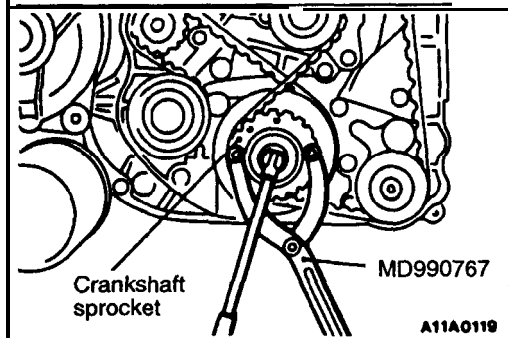
- (3) Press the belt at the shown point by a **finger** to check belt tension. If not, **adjust**.

Standard value: 5-7 mm (.20-.28 in.)



**►C◄ CRANKSHAFT SENSING BLADE INSTALLATION**

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

**►D◄ CRANKSHAFT SPROCKET INSTALLATION**

Use the special tool to install the crankshaft sprocket and bolt.

NOTE

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

NOTES

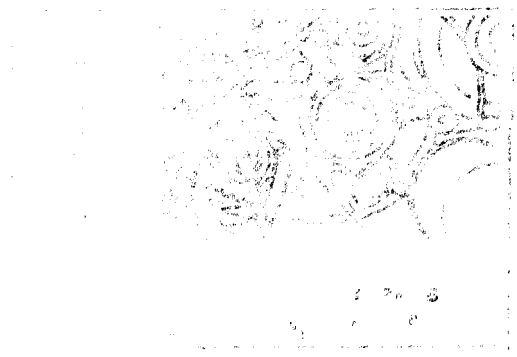
1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the smooth operation of any business and for the protection of the interests of all parties involved.

2. The second part of the document outlines the various methods used to collect and analyze data. It describes the process of gathering information from different sources and how this data is then processed to identify trends and patterns.

3. The final part of the document provides a summary of the findings and conclusions drawn from the analysis. It highlights the key insights gained from the data and offers recommendations for future actions based on these findings.

4. The following table provides a detailed breakdown of the data collected during the study. It shows the distribution of responses across different categories and highlights any significant differences between groups.

5. The data indicates that there is a strong correlation between the variables studied. This suggests that the factors being investigated are closely related and may be influencing each other in a significant way.



ENGINE OVERHAUL. <2.4L>

CONTENTS

11309000142

CRANKSHAFT, FLYWHEEL AND DRIVE PLATE	57	INTAKE MANIFOLD	25
CYLINDER HEAD AND VALVES	34	PISTON AND CONNECTING ROD	48
EXHAUST MANIFOLD AND WATER PUMP	27	ROCKER ARMS AND CAMSHAFT	29
FRONT CASE, COUNTERBALANCE SHAFT AND OIL PAN	40	SEALANTS	7
FUEL AND EMISSION CONTROL PARTS	23	SPECIAL TOOLS	8
GENERAL INFORMATION	2	SPECIFICATIONS	3
General Specifications	2	Rework Dimensions	4
GENERATOR AND IGNITION SYSTEM	11	Service Specifications	3
		Torque Specifications	4
		TIMING BELT	13

GENERAL INFORMATION

11300010113

GENERAL SPECIFICATIONS

Descriptions		Specifications	
Type		In-line OHV, SOHC	
Number of cylinders		4	
Combustion chamber		Pentroof type	
Total displacement cm ³ (cu.in.)		2,350 (143.4)	
Cylinder bore mm (in.)		86.5 (3.41)	
Piston stroke mm (in.)		100.0 (3.94)	
Compression ratio		9.5	
Valve timing (Camshaft identification mark: 1)	Intake valve	Opens (BTDC)	18°
		Closes (ABDC)	58°
	Exhaust valve	Opens (BBDC)	58°
		Closes (ATDC)	18°
Lubrication system		Pressure feed, full-flow filtration	
Oil pump type		Involute gear type	

SPECIFICATIONS

11300030225

SERVICE SPECIFICATIONS

Items	Standard value	Limit
Timing belt		
Autotensioner rod projection length mm (in.)	12 (.47)	-
Autotensioner rod pushed-in amount [when pushed with a force of 98 - 196 N (22 - 44 lbs.)] mm (in.)	1.0 (.039) or less	-
Rocker arms and camshaft		
Camshaft cam height mm (in.) (Identification mark: 1)	Intake	37.39 (1.4720)
	Exhaust	37.47 (1.4752)
Camshaft journal O.D. mm (in.)	45 (1.77)	
Cylinder head and valves		
Cylinder head flatness of gasket surface mm (in.)	Less than 0.05 (.0020)	0.2 (.008)
Cylinder head grinding limit of gasket surface mm (in.) *Total resurfacing depth of both cylinder head and cylinder block	-	*0.2 (.008)
Cylinder head overall height mm (in.)	119.9 - 120.1 (4.720 - 4.728)	-
Cylinder head bolt shank length mm (in.)	-	Max. 99.4 (3.91)
Valve thickness of valve head (Margin) mm (in.)	Intake	1.0 (.039)
	Exhaust	1.2 (.047)
Valve overall height mm (in.)	Intake	112.30 (4.4213)
	Exhaust	114.11 (4.4925)
Valve stem O.D. mm (in.)	Intake	6.0 (.236)
	Exhaust	5.9 (.232)
Valve thickness to valve guide clearance mm (in.)	Intake	0.02 - 0.05 (.0008 - .0020)
	Exhaust	0.03 - 0.07 (.0012 - .0028)
Valve face angle	45 - 45.5°	-
Valve spring free length mm (in.)	51.0 (2.008)	50.0 (1.969)
Valve spring load/installed height N (lbs.)/mm(in.)	267 (60)/44.2 (1.74)	-
Valve spring out-of-squareness	2° or less	Max. 4°
Valve seat valve contact width mm (in.)	0.9 - 1.3 (.035 - .051)	-
Valve guide I.D. mm (in.)	6.0 (.236)	-
Valve guide projection from cylinder head upper surface mm (in.)	14.0 (.55)	-
Valve stem projection mm (in.)	49.30 (1.9409)	49.80 (1.9606)
Front case, counterbalance shaft and oil pan		
Oil pump side clearance mm (in.)	Drive gear	0.08 - 0.14 (.0031 - .0055)
	Driven gear	0.06 - 0.12 (.0024 - .0047)
Oil pressure at curb idle speed kPa (psi) [Oil temperature is 75 to 90°C (167 to 194 °F)]	78 (11.4) or more	
Piston and connecting rod		
Piston O.D. mm (in.)	86.5 (3.41)	-
Piston ring side clearance mm (in.)	No. 1	0.03 - 0.07 (.0012 - .0028)
	No. 2	0.03 - 0.07 (.0012 - .0028)
Piston ring end gap mm (in.)	No. 1	0.25 - 0.35 (.0098 - .0138)
	No. 2	0.40 - 0.55 (.0157 - .0217)
	Oil ring side rail	0.10 - 0.40 (.0039 - .0157)
Piston pin O.D. mm (in.)	22.0 (.87)	-
Piston pin press-in load N (lbs.) (Room temperature)	7,350 - 17,200 (1,653 - 3,858)	-
Crankshaft pin oil clearance mm (in.)	0.02 - 0.05 (.0008 - .0020)	0.1 (.004)
Connecting rod big end side clearance mm (in.)	0.10 - 0.25 (.0039 - .0098)	0.4 (.016)

Items	Standard value	Limit
Crankshaft, flywheel and drive plate		
Crankshaft end play mm (in.)	0.05 – 0.18 (.0020 – .0071)	0.25 (.0098)
Crankshaft journal O.D. mm (in.)	57 (2.24)	–
Crankshaft pin O.D. mm (in.)	45 (1.77)	–
Crankshaft journal oil clearance mm (in.)	0.02 – 0.04 (.0008 – .0016)	0.1 (.004)
Cylinder block		
Bearing cap bolt shank length mm (in.)		Max. 71.1 (2.80)
Piston to cylinder clearance mm (in.)	0.02 – 0.04 (.0008 – .0016)	–
Cylinder block flatness of gasket surface mm (in.)	0.05 (.0020)	0.1 (.004)
Cylinder block grinding limit of gasket surface mm (in.) *Total resurfacing depth of both cylinder head and cylinder block		*0.2 (.008)
Cylinder block overall height mm (in.)	289.9 – 290.1 (11.413 – 11.421)	–
Cylinder block I.D. mm (in.)	86.50 (3.4055)	–
Cylindricity mm (in.)	0.01 (.0004) or less	–

REWORK DIMENSIONS

Items	Standard value
Cylinder head and valve	
Oversize rework dimensions of valve guide hole mm (in.) (both intake and exhaust)	0.05 O.S. 11.05 – 11.07 (.4350 – .4358)
	0.25 O.S. 11.25 – 11.27 (.4429 – .4437)
	0.50 O.S. 11.50 – 11.52 (.4528 – .4535)
Intake oversize rework dimensions of valve seat hole mm (in.)	0.30 O.S. 34.30 – 34.33 (1.3504 – 1.3516)
	0.60 O.S. 34.60 – 34.63 (1.3622 – 1.3634)
Exhaust oversize rework dimensions of valve seat hole mm (in.)	0.30 O.S. 31.80 – 31.83 (1.2520 – 1.2531)
	0.60 O.S. 32.10 – 32.13 (1.2638 – 1.2650)
Crankshaft, flywheel and drive plate	
Crankshaft out-of-roundness and taper of journal pin mm (in.)	0.01 (.0004) or less

NOTE

O.D. : Outer diameter

I.D. : Inner diameter

O.S. : Oversize diameter

TORQUE SPECIFICATIONS

Items	Nm	ft. lbs.
Generator and ignition system		
Water pump pulley	11	8
Lock bolt	14	10
Generator brace	24	17
Generator pivot nut	23	17
Crankshaft pulley	25	18
Ignition coil assembly	10	7
Ignition power transistor assembly	5	3.6
Spark plug	25	18

Items	Nm	ft. lbs.
Camshaft position sensor	10	7
Camshaft position sensor support	14	10
Camshaft position sensing cylinder	22	16
Timing belt		
Timing belt front cover M6 flange bolt	11	8
Timing belt front cover M6 washer assembled bolt	9	7
Timing belt front cover M8	14	10
Crankshaft position sensor	9	7
Tensioner arm	21	15
Auto tensioner	24	17
Idler pulley	36	26
Oil pump sprocket	55	40
Crankshaft bolt	120	87
Tensioner B	19	14
Counterbalance shaft sprocket	46	33
Engine support bracket	45	33
Camshaft sprocket bolt	90	65
Timing belt rear cover M8	14	10
Timing belt rear cover M10	3 1	22
Fuel and emission parts		
Throttle body	19	14
EGR valve	22	16
Fuel pressure regulator	9	7
Fuel rail	12	9
Intake manifold		
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Water inlet fitting	13	9
Water outlet fitting	13	9
Thermostat housing	24	18
Manifold differential pressure sensor	9	7
Intake manifold stay	31	22
Intake manifold	18	13
Exhaust manifold and water pump		
Oil dipstick guide	60	43
Heat protector	14	10
Exhaust manifold M8	28	20
Exhaust manifold M10	30	22
Water inlet pipe	14	10
Water pump	14	10
Rocker arms and camshaft		
Rocker cover	3.3	2.4
Rocker arm shaft	32	23

Items	Nm	ft. lbs.
Cylinder head and valves		
Cylinder head bolt [Tighten to 78 Nm (58 ft. lbs.) and then completely loosen before finally tightening with above procedure.]	20 + 90° + 90°	14.5 + 90° + 90°
Front case, counterbalance shaft and oil pan		
Drain plug	40	29
Oil pan	7	5
Oil screen	19	14
Oil pressure switch	10	7
Relief plug	45	33
Oil filter bracket	19	14
Plug	24	17
Flange bolt	37	27
Oil pump cover screw	10	7
Oil pump cover bolt	17	12
Front case	24	17
Piston and connecting rod		
Connecting rod cap	20 + 90° – 100°	14.5 + 90° – 100°
Crankshaft, flywheel and drive plate		
Flywheel bolt	135	98
Drive plate bolt	135	98
Rear plate	11	8
Bell housing cover	9	7
Oil seal case	11	8
Bearing cap bolt	25 + 90° – 100°	14.5 + 90° – 100°

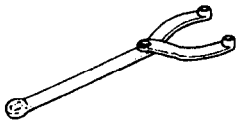
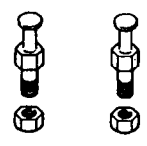
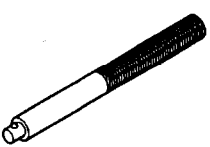
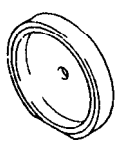

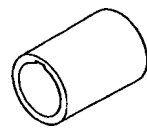
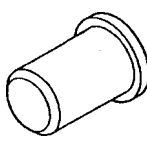
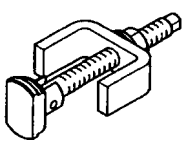
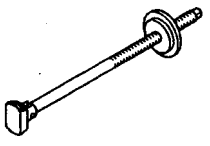
SEALANTS


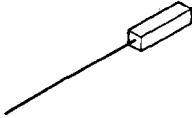
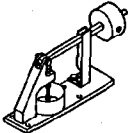

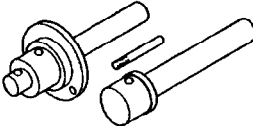
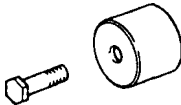
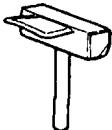
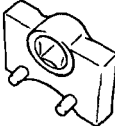
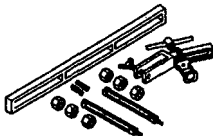
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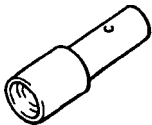

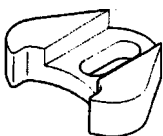

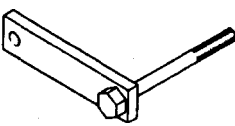
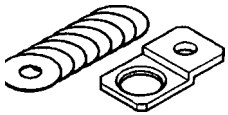
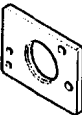
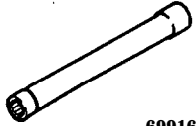
Items	Specified sealant
Camshaft position sensor support	Mitsubishi Genuine Part No. MD970389 or equivalent
Engine support bracket	3M ATD Part No. 8660 or equivalent
Thermostat housing	Mitsubishi Genuine Part No. MD970389 or equivalent
Water outlet fitting	Mitsubishi Genuine Part No. MD970389 or equivalent
Engine coolant temperature sensor	3M NUT Locking Part No. 4171 or equivalent
Engine coolant temperature gauge unit	3M ATD Part No. 8660 or equivalent
Oil pressure switch	3M ATD Part No. 8660 or equivalent
Oil pan	Mitsubishi Genuine Part No. MD970389 or equivalent
Oil seal case	Mitsubishi Genuine Part No. MD970389 or equivalent

SPECIAL TOOLS

11300060200

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder	MB990767-01	Holding camshaft sprocket when loosening or torquing bolt.
	MD998719 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt.
	MB990938 Handle	MB990938-01	Installation of crankshaft rear oil seal
	MD998776 Crankshaft rear oil seal installer	MD998376-01	Installation of crankshaft rear oil seal
	MD998162 Plug wrench Use with MD998783	MD998162-01	Removal and installation of front case cap plug
	MD998285 Crankshaft front oil seal guide	MD998285-01	Installation of crankshaft front oil seal
	MD998375 Crankshaft front oil seal installer	MD998375-01	Installation of crankshaft front oil seal
	MD998371 Silent shaft bearing puller	MD998371-01 Use with MIT304204	Removal of counterbalance shaft rear bearing
	MD998372 Silent shaft bearing puller	MD998372-01 Use with MIT304204	Removal of counterbalance shaft rear bearing

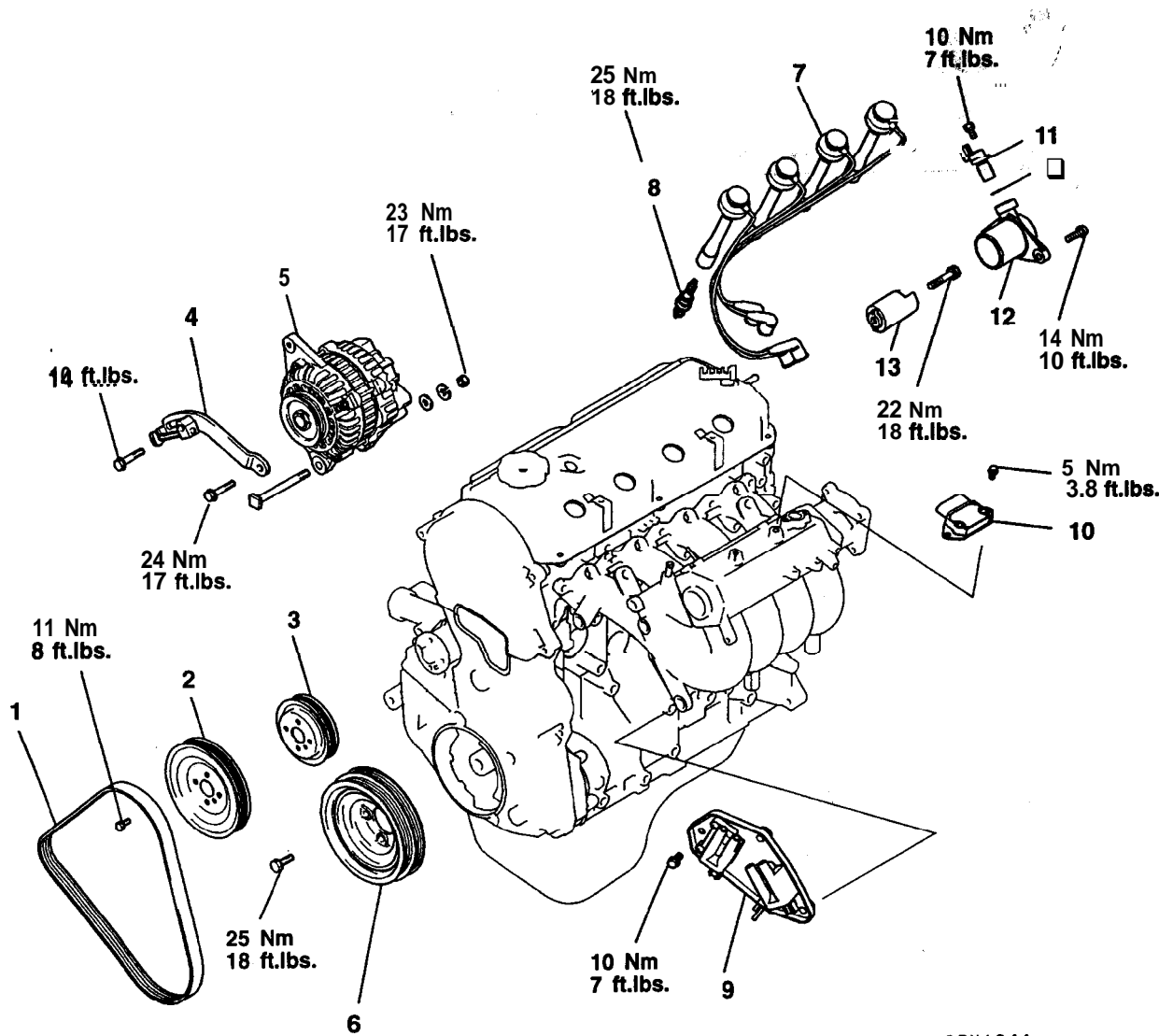
Tool	Tool number and name	Supersession	Application
	MD998441 Lash adjuster retainer	–	Air bleed of lash adjuster
	MD998442 Air bleed wire	–	Air bleed of lash adjuster
	MD998440 Leak-down tester	–	Leak-down test of lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed
	MD998705 Silent shaft bearing installer	MD998373-01 Use with MB990938-01	Installation of counterbalance shaft bearing
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
	MD998727 Oil pan remover	MD998727-01	Removal of oil pan
	MD998767 Tension pulley wrench	MD998752-01	Installation of auto tensioner
	MD998772 Valve spring compressor	General service tool	Compression of valve spring

Tool	Tool number and name	Supersession	Application
	MD998774 Valve steam seal installer	MD998774-01	Installation of valve steam seal
	MD998778 Crankshaft sprocket puller		Removal of crankshaft sprocket
	MD998785 Sprocket stopper		Supporting counterbalance shaft sprocket
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper	-	Supporting flywheel and drive plate
	MD998783 Plug wrench retainer Use with MD998162	-	Removal and installation of front case cap plug
	MB991603 Bearing installer stopper		Removal and installation of rear bearing
 6991654	MB991654 Cylinder head bolt wrench (12)		Removal and installation of cylinder head bolt

GENERATOR AND IGNITION SYSTEM

11300100148

REMOVAL AND INSTALLATION

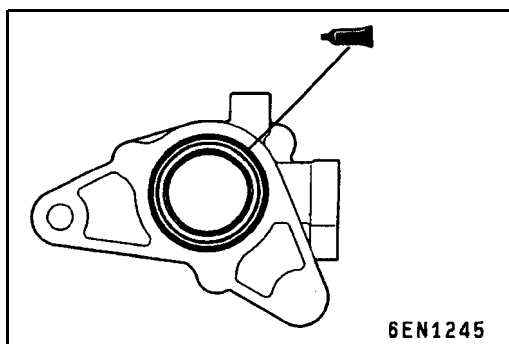


6EN1244

Removal steps

1. Drive belt
2. Water pump pulley
3. Power steering pump pulley
4. Generator brace
5. Generator
6. Crankshaft pulley
7. Spark plug cable

8. Spark plug
9. Ignition coil assembly
10. Ignition power transistor assembly
11. Camshaft position sensor
12. Camshaft position sensor support
13. Camshaft position sensing cylinder



INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT POSITION SENSOR SUPPORT INSTALLATION

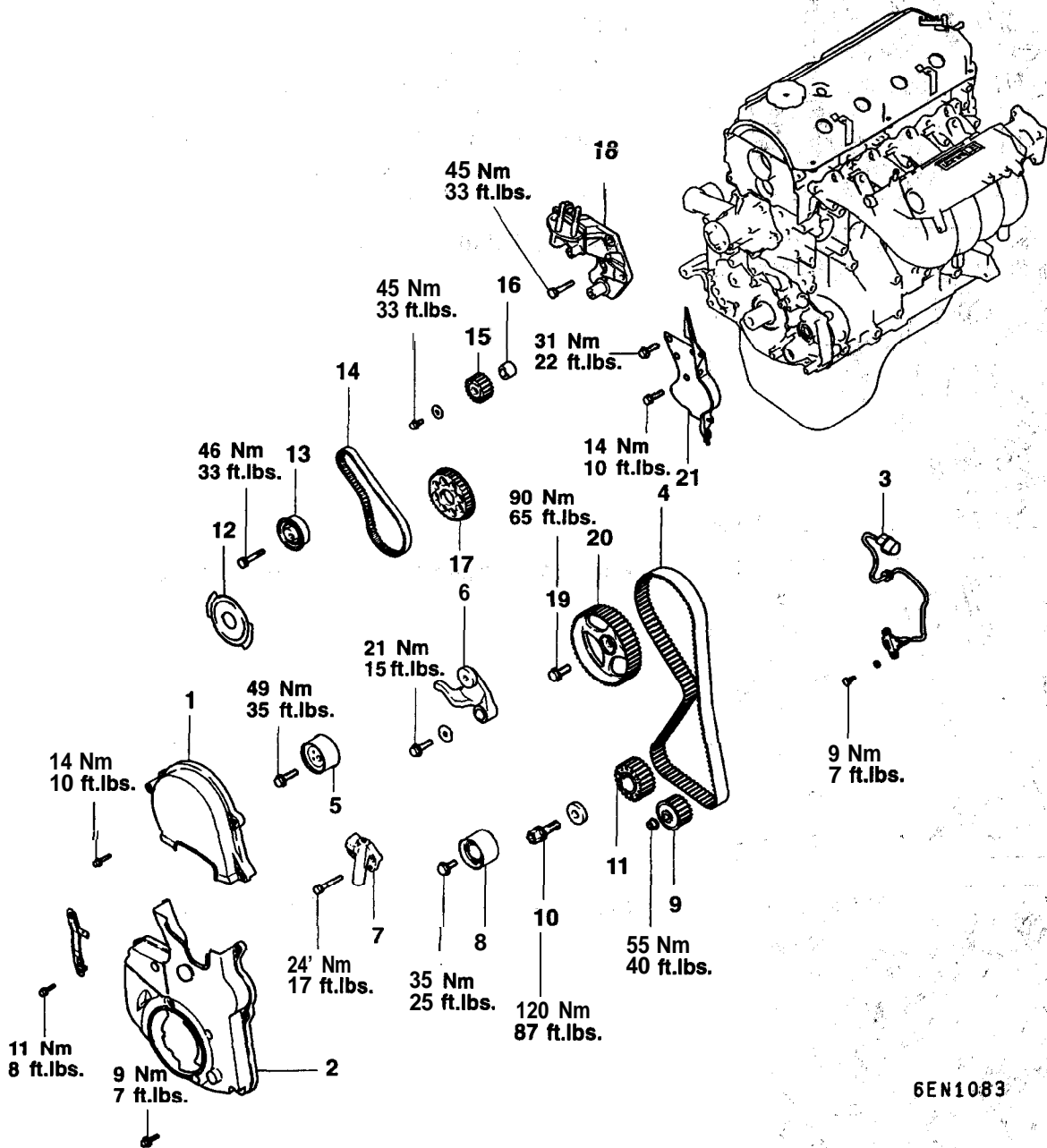
- (1) Apply a 3 mm bead of form-in-place gasket (FIPG) to the area shown.

Specified sealant:

Mitsubishi Genuine Part No. MD970389 or equivalent.

TIMING BELT

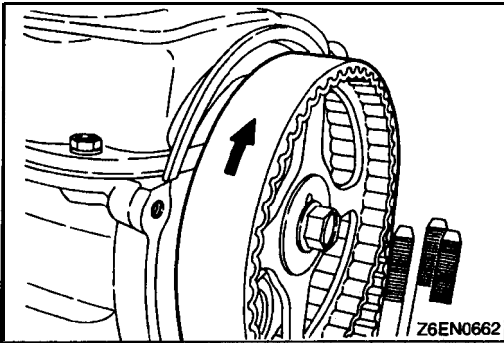
REMOVAL AND INSTALLATION



6EN1083

Removal steps

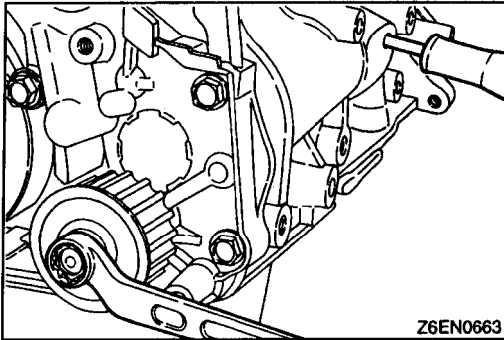
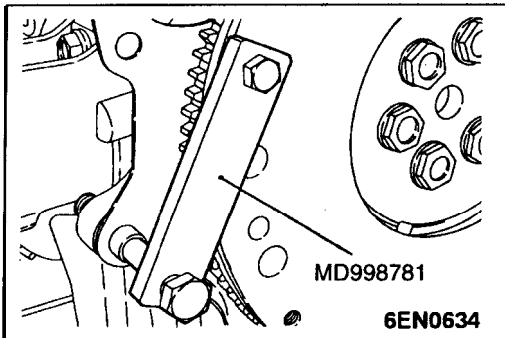
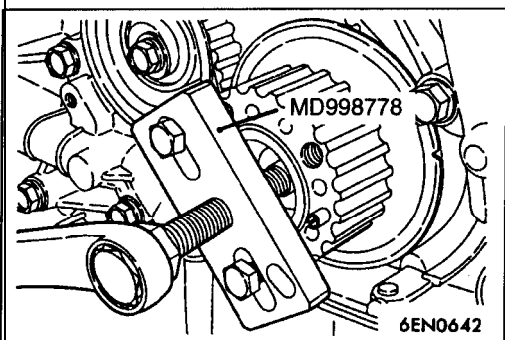
- | | | | | | |
|-----|----------------------------------|-------------------------|-----|-----|-----------------------------------|
| | 1. Timing belt front upper cover | | | | |
| | 2. Timing belt front lower cover | | | | |
| | 3. Crankshaft position sensor | | | | |
| ◀A▶ | ▶J▶ | 4. Timing belt | ▶E▶ | ▶E▶ | 12. Flange |
| | ▶I▶ | 5. Tensioner pulley | ▶F▶ | ▶D▶ | 13. Tensioner "B" |
| | | 6. Tensioner arm | | ▶C▶ | 14. Timing belt "B" |
| | ▶H▶ | 7. Auto tensioner | ▶G▶ | | 15. Counterbalance shaft sprocket |
| | | 8. Idler pulley | | ▶B▶ | 16. Spacer |
| ▶B▶ | ▶G▶ | 9. Oil pump sprocket | ▶H▶ | ▶A▶ | 17. Crankshaft sprocket "B" |
| ▶C▶ | ▶F▶ | 10. Crankshaft bolt | | | 18. Engine support bracket |
| ▶D▶ | | 11. Crankshaft sprocket | | | 19. Camshaft sprocket bolt |
| | | | | | 20. Camshaft sprocket |
| | | | | | 21. Timing belt rear, cover |

**REMOVAL SERVICE POINTS****◀A▶ TIMING BELT REMOVAL**

Mark belt running direction for reinstallation.

NOTE

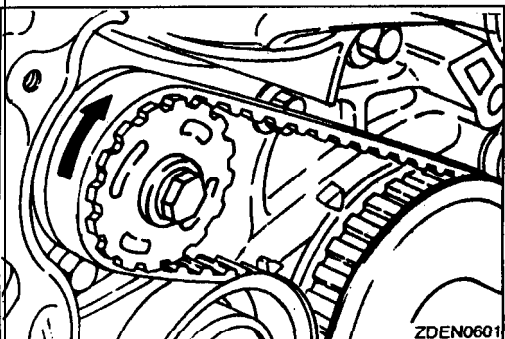
- (1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.

◀B▶ OIL PUMP SPROCKET REMOVAL**◀C▶ CRANKSHAFT BOLT LOOSENING****◀D▶ CRANKSHAFT SPROCKET REMOVAL****◀E▶ TIMING BELT "B" REMOVAL**

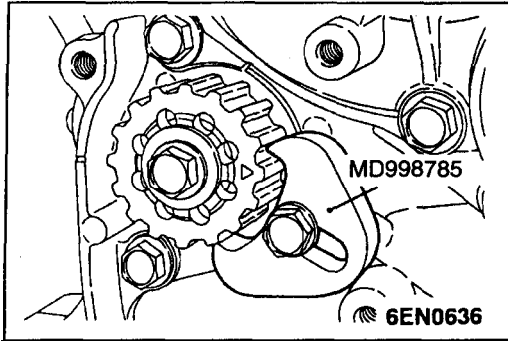
- (1) Make a mark on the back of the timing belt indicating the direction of rotation so it may be reassembled in the same direction if it is to be reused.

NOTE

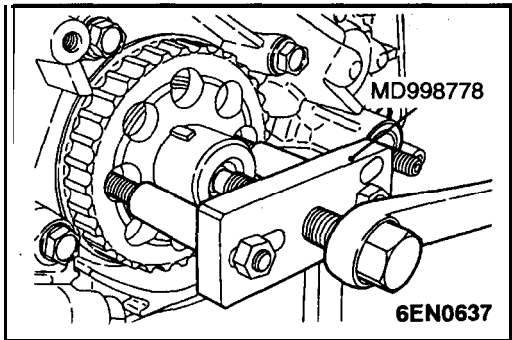
- (1) Water or oil on the belt shortens **its** life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and **water**. **These parts** should not be washed. Replace parts if seriously contaminated.



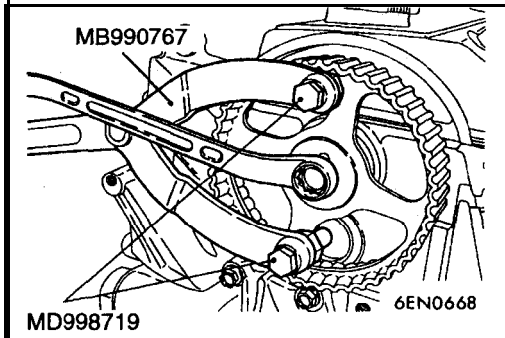
(2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.



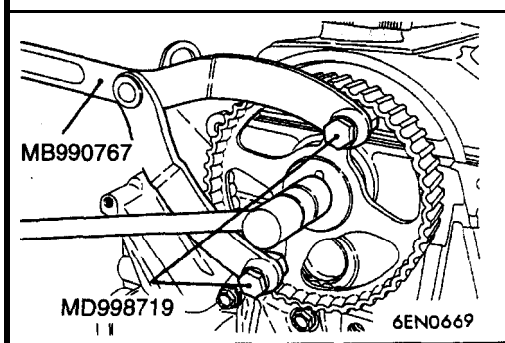
◀F▶ COUNTERBALANCE SHAFT SPROCKET REMOVAL



◀G▶ CRANKSHAFT SPROCKET "B" REMOVAL

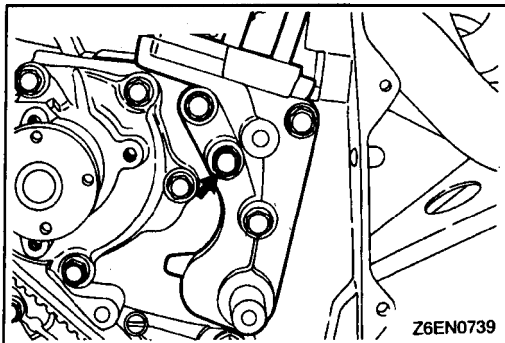


◀H▶ CAMSHAFT SPROCKET BOLT LOOSENING



INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT SPROCKET TIGHTENING

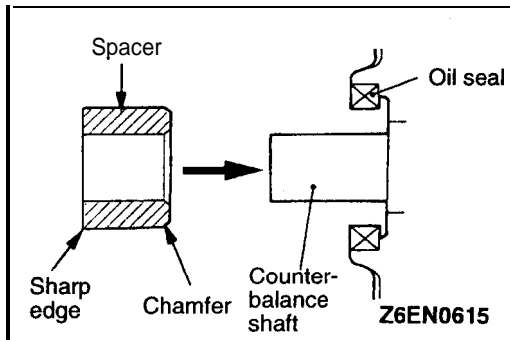


►B◄ ENGINE SUPPORT BRACKET INSTALLATION

Coat the bolts illustrated with sealant before tightening.

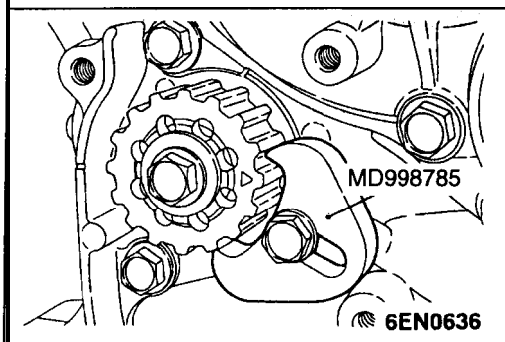
Specified sealant:

3M ATD Part No. 8660 or equivalent

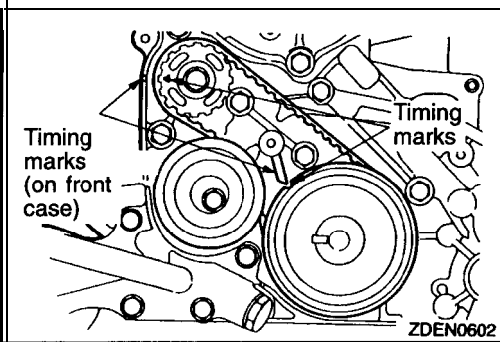


►C◄ SPACER INSTALLATION

Install the spacer with the chamfered end **toward the** oil seal.

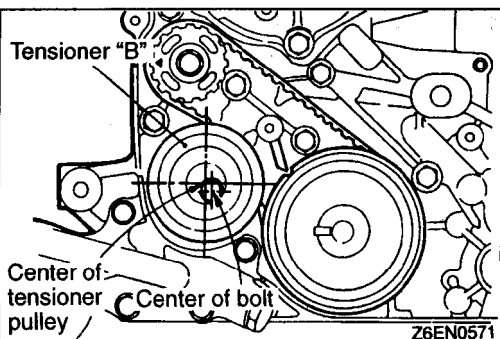


►D◄ COUNTERBALANCE SHAFT S P R O C K E T INSTALLATION

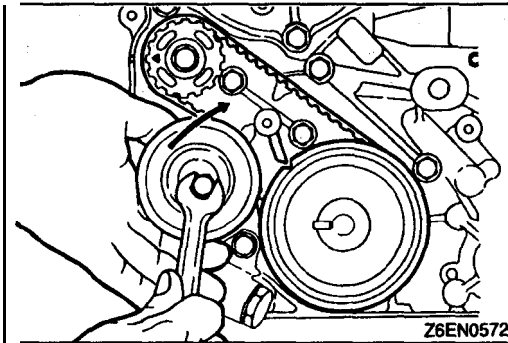


►E◄ TIMING BELT "B" INSTALLATION

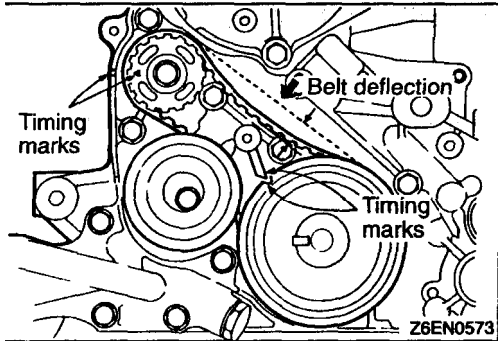
- (1) Align timing marks on the crankshaft sprocket "B" and counterbalance shaft sprocket with **the marks on the front**, case respectively.
- (2) Install the timing belt "B" on the crankshaft sprocket "B" and counterbalance shaft sprocket. There should be no slack on the tension side.



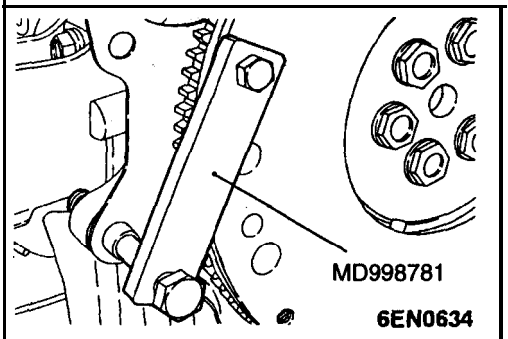
- (3) Make sure that the relationship between the tensioner pulley center and the bolt center is as **shown** in the illustration.



Z6EN0572

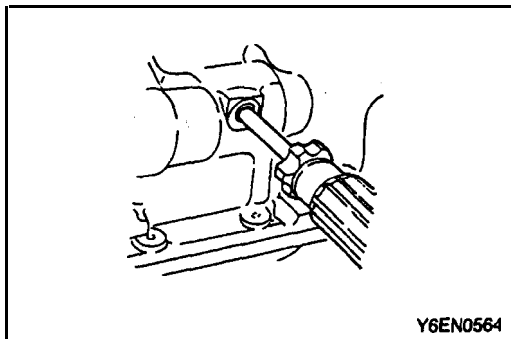


Z6EN0573

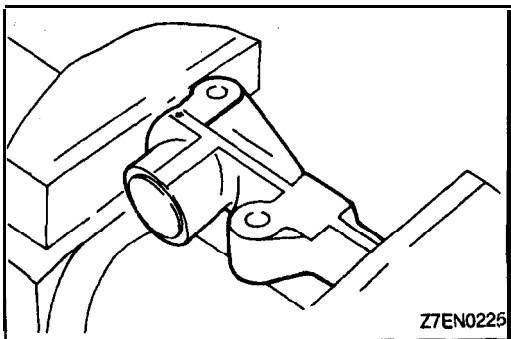


MD998781

6EN0634



Y6EN0564



Z7EN0225

- (4) Move the tensioner "B" in the **direction** of arrow while lifting with a finger to give a sufficient tension to the tension side of timing belt. In this condition, tighten bolt to secure tensioner "B". When the bolt is tightened, use care to prevent shaft from turning together. If shaft is turned together, belt will be **overtensioned**.

- (5) Check to ensure that timing marks on sprockets and front case are in alignment.
- (6) Press with index finger the center of span on tension side of timing belt "B". The bolt must deflect **5–7 mm (.20–.28 in.)**.

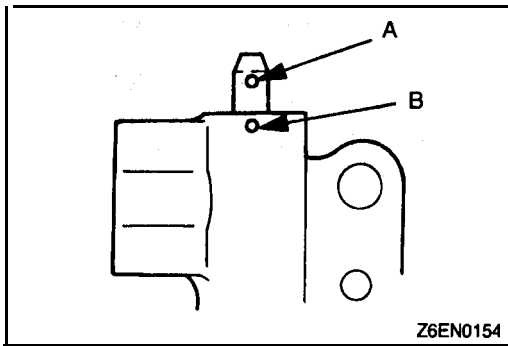
►F◄ CRANKSHAFT BOLT TIGHTENING

►G◄ OIL PUMP SPROCKET INSTALLATION

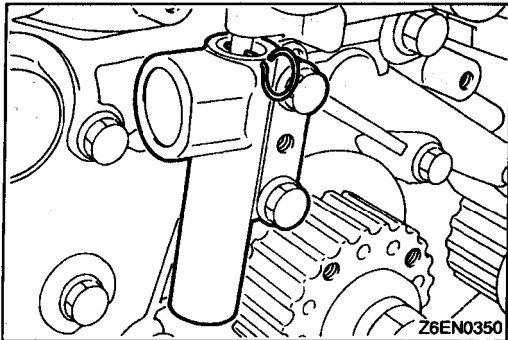
- (1) Insert a Phillips screwdriver [shank **diameter 8 mm (.31 in.)** shaft] through the plug **hole** on the left side of the cylinder block to block the left counterbalance shaft.
- (2) Install the oil pump sprocket.
- (3) Apply a proper amount of engine oil to the bearing surfaces of the nuts.
- (4) Tighten the nuts to the specified torque.

►H◄ AUTO TENSIONER INSTALLATION

- (1) If the auto tensioner rod is in its fully extended **position**, reset it as follows.
- (2) Clamp the auto-tensioner in **the** vise with, soft **jaws**.



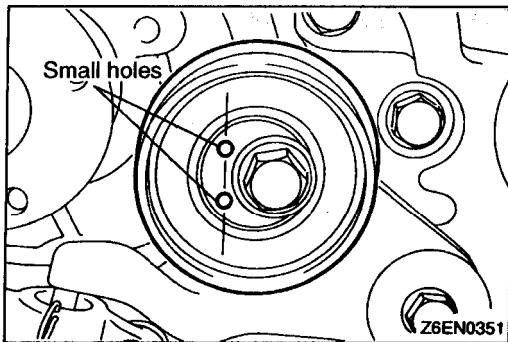
- (3) Push in the rod little by little with the **vise** until the set hole A in the rod is **aligned with** the hole B in the cylinder.
- (4) **Insert** a wire [1.4 mm (.055 in.) in diameter] into the set holes.
- (5) Unclamp the auto tensioner **from** the vise.



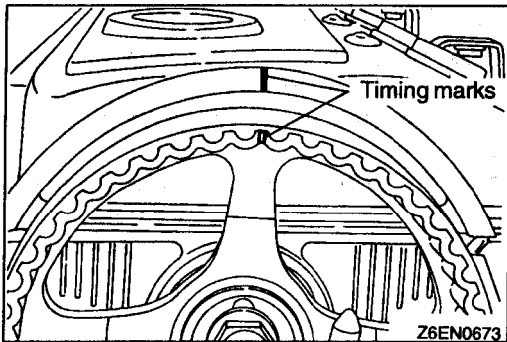
- (6) Install the auto tensioner to front case **and** tighten to the specified torque.

Caution

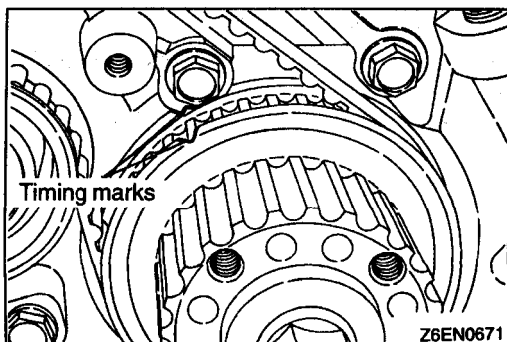
Leave the wire installed in the auto tensioner.

**►◄ TENSIONER PULLEY INSTALLATION**

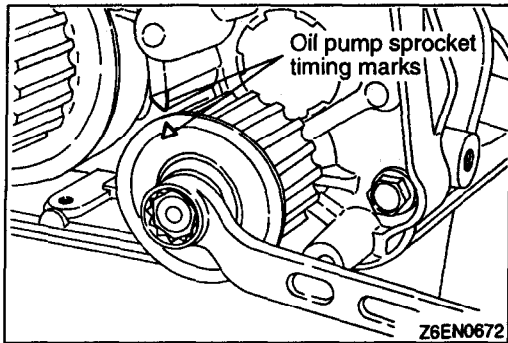
Install the tensioner pulley in such **direction** that its **two** small holes are arranged vertically.

**►◄ TIMING BELT INSTALLATION**

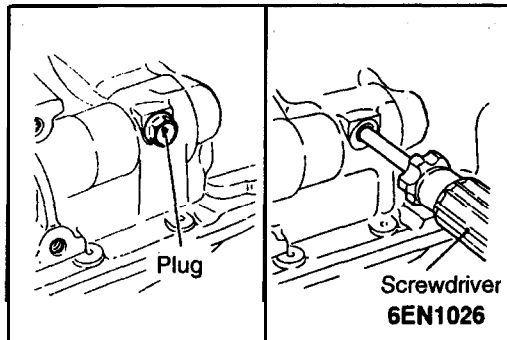
- (1) Check that the timing belt tensioner and have been, installed in position. (See ►◄)
- (2) Align timing mark on camshaft sprocket with timing mark on cylinder head.



- (3) Align timing mark on crankshaft sprocket with timing mark on front case.

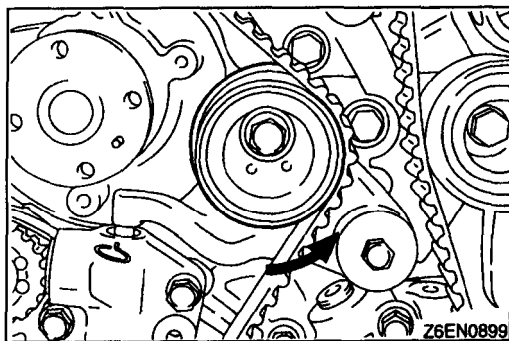


- (4) Align the timing mark on oil pump sprocket with its mating mark.

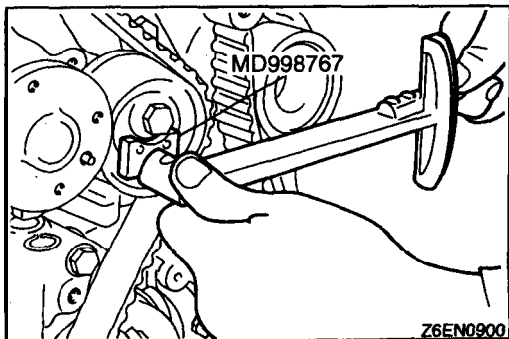


- (5) Remove the plug on cylinder block and insert a Phillips, screwdriver [shank diameter 8 mm. (.31 in.)] through the hole (Engine with counterbalance shafts). If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20–25 mm (.8–1.0 in.), **turn the oil pump sprocket one turn and realign timing marks**. Then check to ensure that the screwdriver can be inserted **60 mm (2.4 in.)** or more. Keep the screwdriver inserted until installation of **timing belt** is finished.

- (6) Install the timing belt on the crankshaft sprocket, idler pulley, camshaft sprocket, and tensioner pulley in that order.



- (7) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.
 (8) Check that all timing marks are lined up.
 (9) Remove the screwdriver inserted in step (5) and fit the **plug**.
 (10) **Give** the crankshaft a quarter counterclockwise turn. Then, turn it clockwise until the timing marks are lined up again.

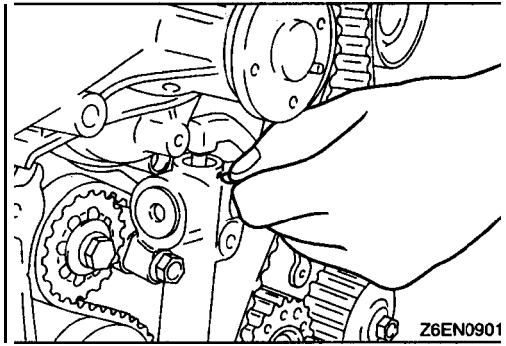


- (11) **Install** the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

NOTE

If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0–5 Nm (0–3.6 ft.lbs.).

- (12) **Torque to 3.5 Nm (2.5 ft.lbs.) with the torque wrench.**
 (13) **Holding** the tensioner pulley with the special tool and torque wrench, tighten the center bolt to specification.

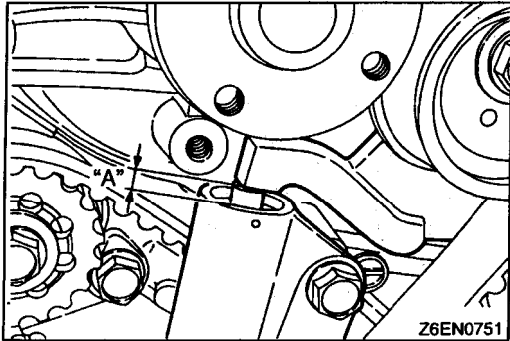


(14) After giving two clockwise turns to the crankshaft, let it alone for approx. 15 minutes. Then, make sure that the auto tensioner setting wire moves freely.

NOTE

If the wire does not move freely, repeat step (10) above until it moves freely.

(15) Remove the auto tensioner setting wire.



(16) Measure the distance "A" (between the tensioner arm and auto tensioner body).

Standard value: 3.8-4.5 mm (.15-.18 in.)

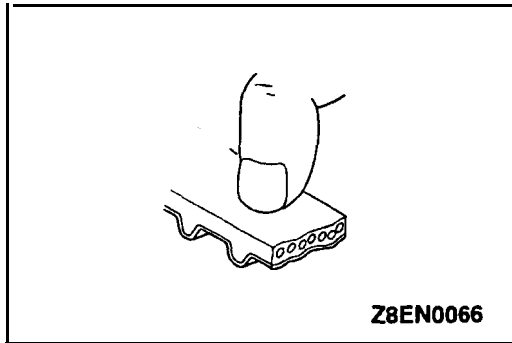
11300200114

INSPECTION

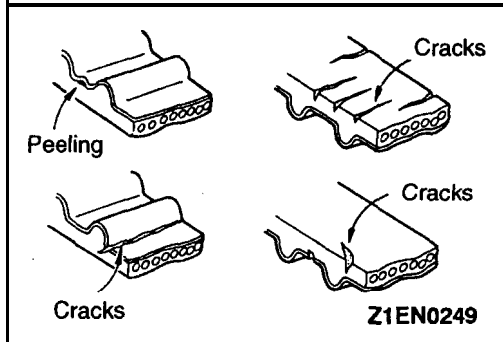
TIMING BELT

Replace belt if any of the following **conditions** exist.

- (1) Hardening of back **rubber**.
Back side is glossy without resilience, and leaves no indent when pressed **with** fingernail.:

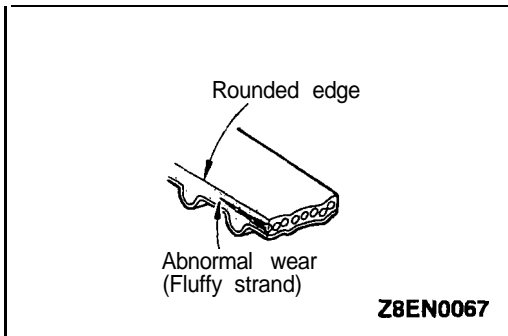


Z8EN0066



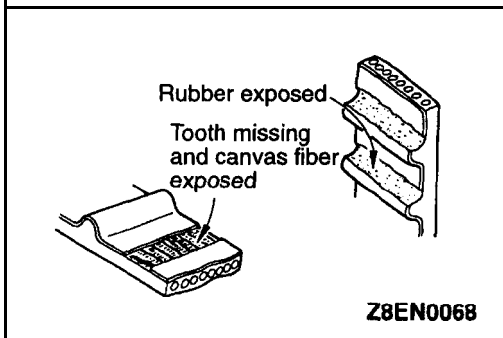
Z1EN0249

- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on rib root.
- (5) Cracks on belt sides.



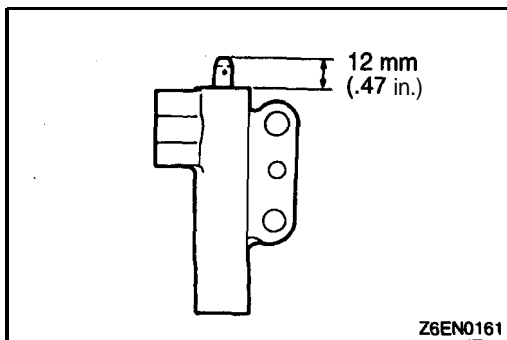
Z8EN0067

- (6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.



Z8EN0068

- (7) Abnormal wear on teeth.
- (8) Missing tooth.

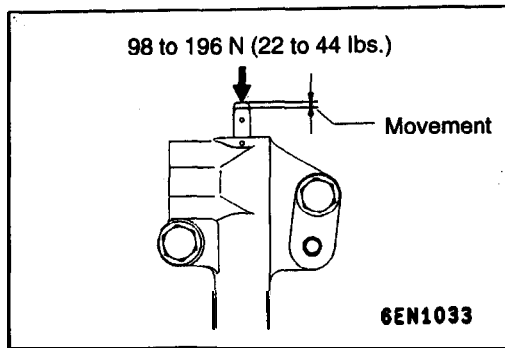


Z6EN0161

AUTO TENSIONER

- (1) Check the auto tensioner for possible leaks and replace as necessary.
- (2) Check the rod end for wear or damage and replace as necessary.
- (3) Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

Standard value: 12 mm (.47 in.)

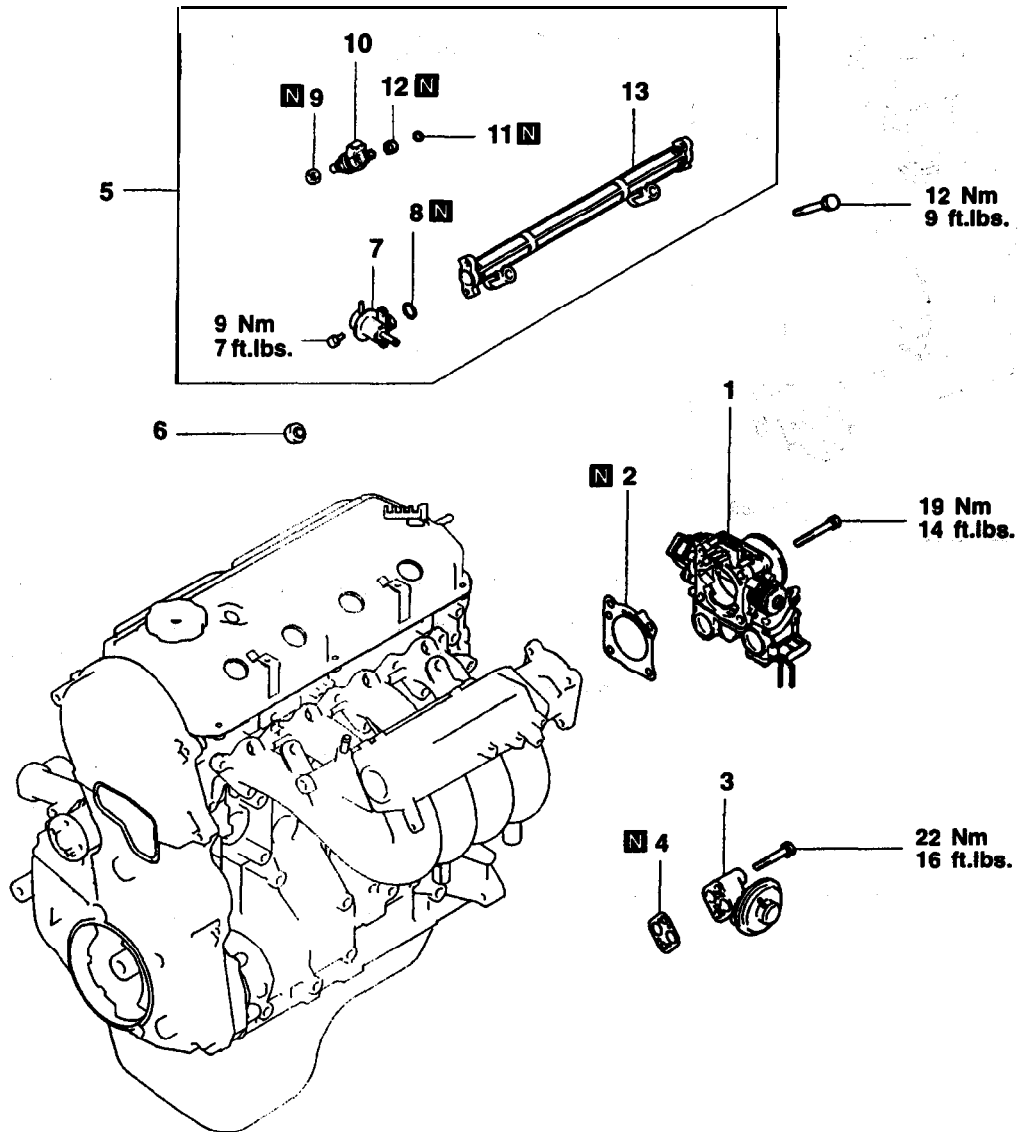


- (4) Press the rod with a force of 98 to 196 N (22 to 44 lbs.) and measure its protrusion.
- (5) If the measured value is 1 mm (0.39 in) or more shorter than the value obtained in step (3), replace the auto tensioner.

FUEL AND EMISSION CONTROL PARTS

11300220080

REMOVAL AND INSTALLATION



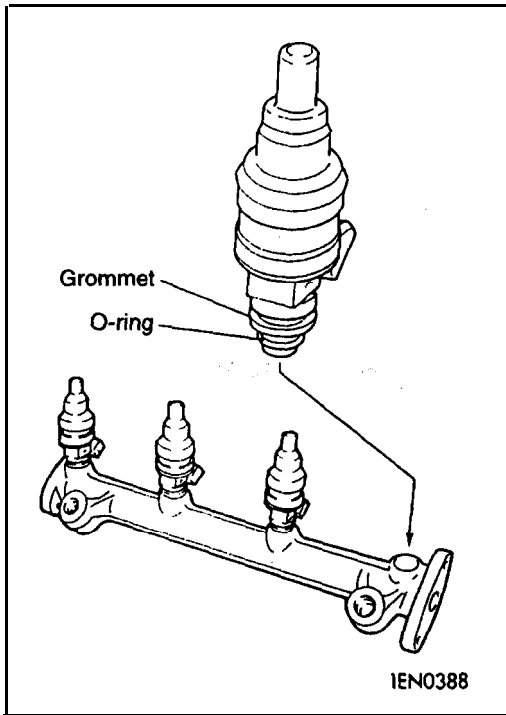
6EN1084

Removal steps

1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. Injectors and fuel rail
6. Insulator
7. Fuel pressure regulator

- ▶B◀ 8. O-ring
- 9. Insulator
- ▶A◀ 10. Injectors
- 11. O-ring
- 12. Grommet
- 13. Fuel rail

11 F-24 ENGINE OVERHAUL <2.4L> – Fuel and Emission Control Parts



INSTALLATION SERVICE POINTS

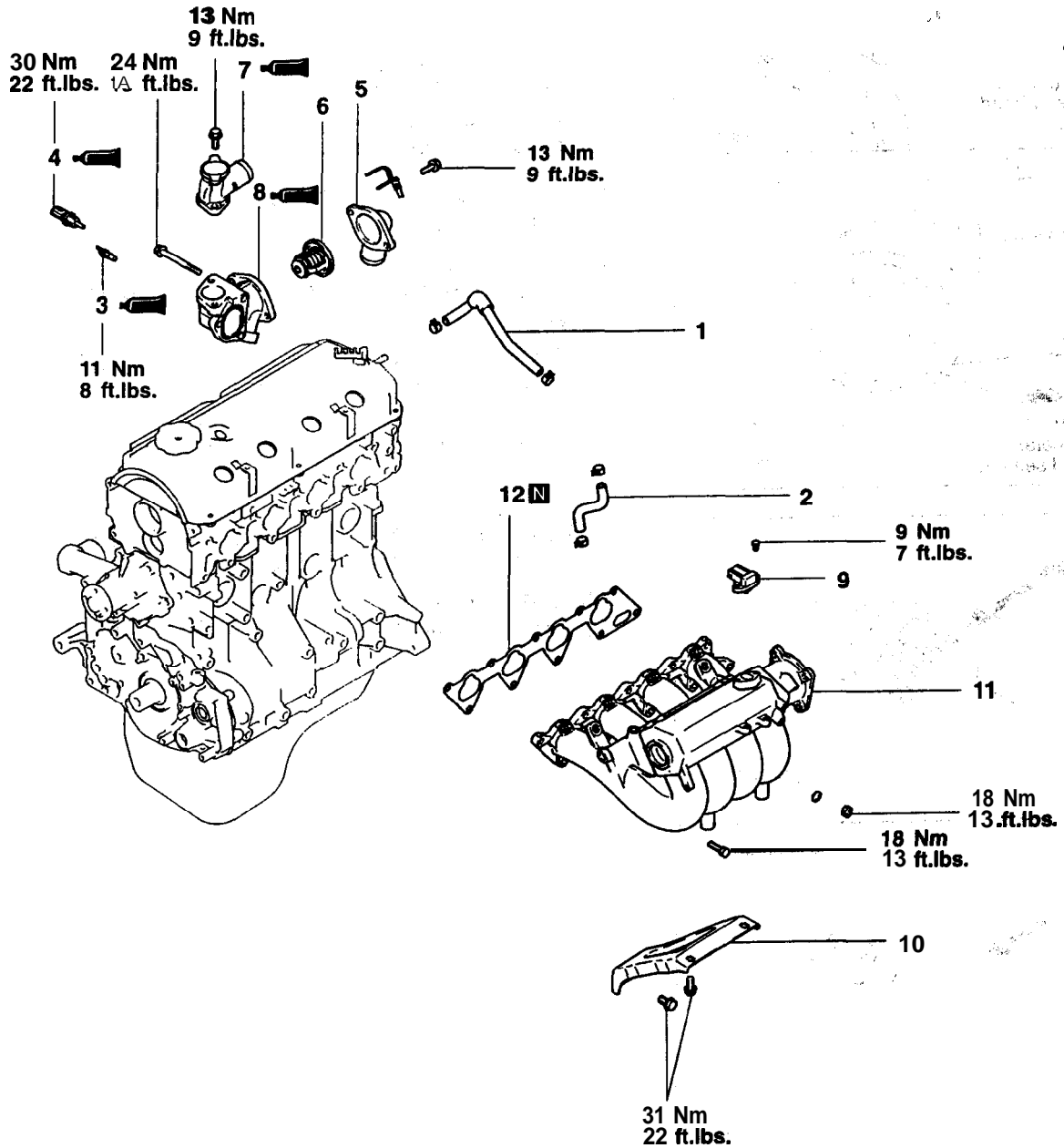
▶A◀ INJECTORS / INJECTOR CLIP INSTALLATION

- (1) Before installing an injector, the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.
- (2) Install injector top end into fuel rail. Be careful not to damage O-ring during installation.

▶B◀ FUEL PRESSURE REGULATOR INSTALLATION

Before installing the pressure regulator, the O-ring must be lubricated with a drop of clean engine oil to aid in installation.

INTAKE MANIFOLD REMOVAL AND INSTALLATION

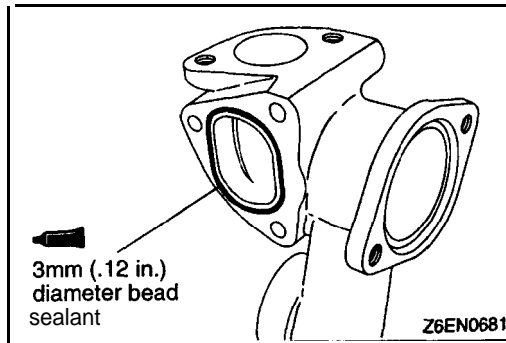


6EN1091

Removal steps

- 1. Water hose
- 2. Water hose
- ▶D◀ 3. Engine coolant temperature gauge unit
- ▶C◀ 4. Engine coolant temperature sensor
- 5. Water inlet fitting
- 6. Thermostat

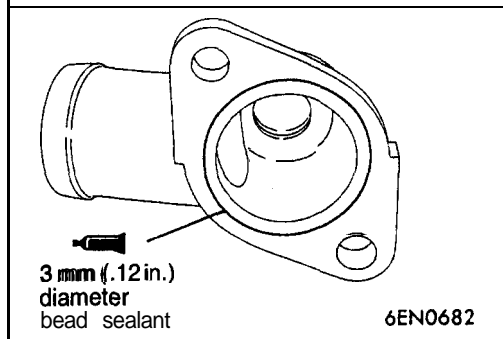
- ▶B◀ 7. Water outlet fitting
- ▶A◀ 8. Thermostat housing
- 9. Manifold differential pressure sensor
- 10. Intake manifold stay
- 11. Intake manifold
- 12. Intake manifold gasket

**INSTALLATION SERVICE POINTS****▶A◀ SEALANT APPLICATION TO THERMOSTAT HOUSING****Specified sealant:**

Mitsubishi Genuine Part No. **MD970389** or equivalent

NOTE

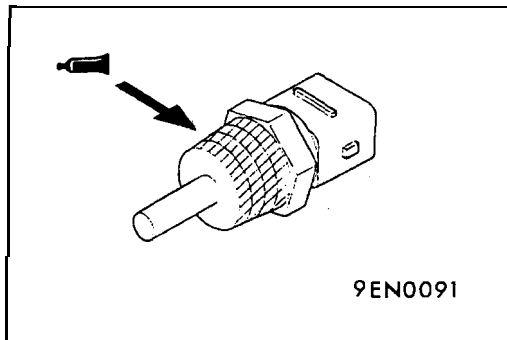
- (1) Be sure to install the housing quickly while the sealant is wet (within 15 minutes).
- (2) After installation, keep the sealed area away from the oil and coolant for approx. one hour.

**▶B◀ SEALANT APPLICATION TO WATER OUTLET FITTING****Specified sealant:**

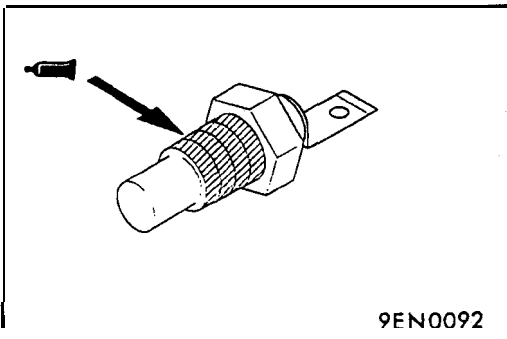
Mitsubishi Genuine Part No. **MD970389** or equivalent

NOTE

- (1) Be sure to install the housing quickly while the sealant is wet (within 15 minutes).
- (2) After installation, keep the sealed area away from the oil and coolant for approx. one hour.

**▶C◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR****Specified sealant:**

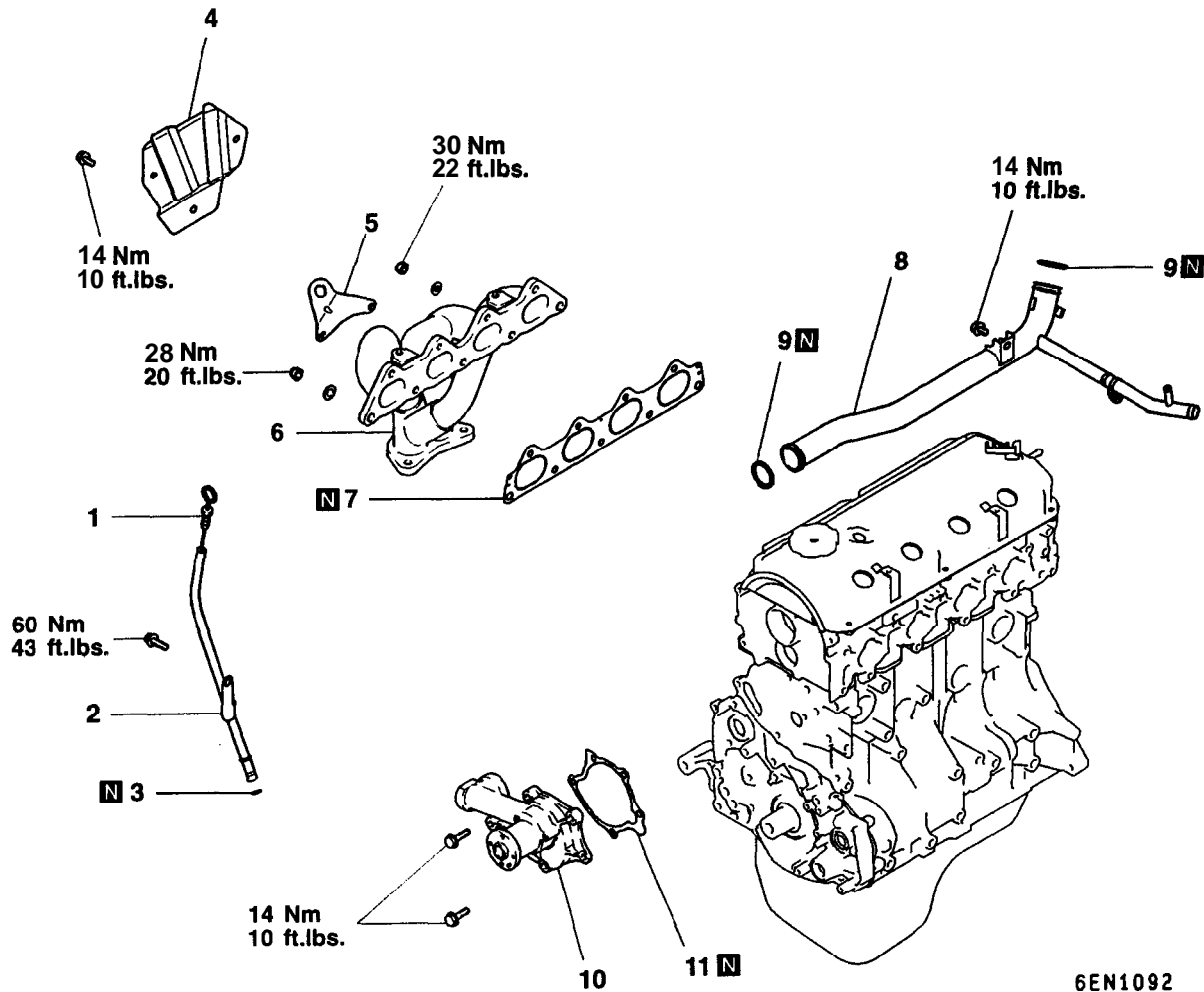
3M Nut Locking Part No. 4171 or equivalent

**▶D◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT**

Specified sealant: 3M ATD Part No. 8680 or equivalent

EXHAUST MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION



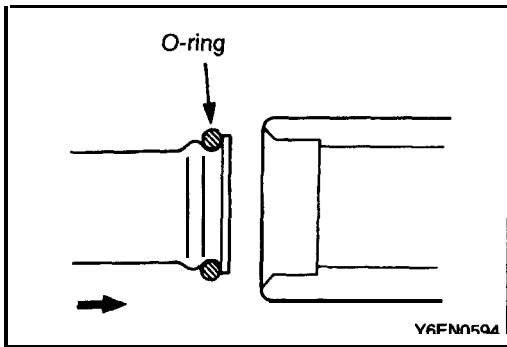
6EN1092

Removal steps

1. Oil dipstick
2. Oil dipstick guide
3. O-ring
4. Heat protector
5. Engine hanger
6. Exhaust manifold

7. Exhaust manifold gasket
8. Water inlet pipe
9. O-ring
10. Water pump
11. Water pump gasket

11F-28 ENGINE OVERHAUL <2.4L> – Exhaust Manifold and. Water Pump



INSTALLATION SERVICE POINT

▶A◀ WATER PIPE/O-RING INSTALLATION

- (1) Wet the O-ring (with water) to facilitate assembly.

Caution

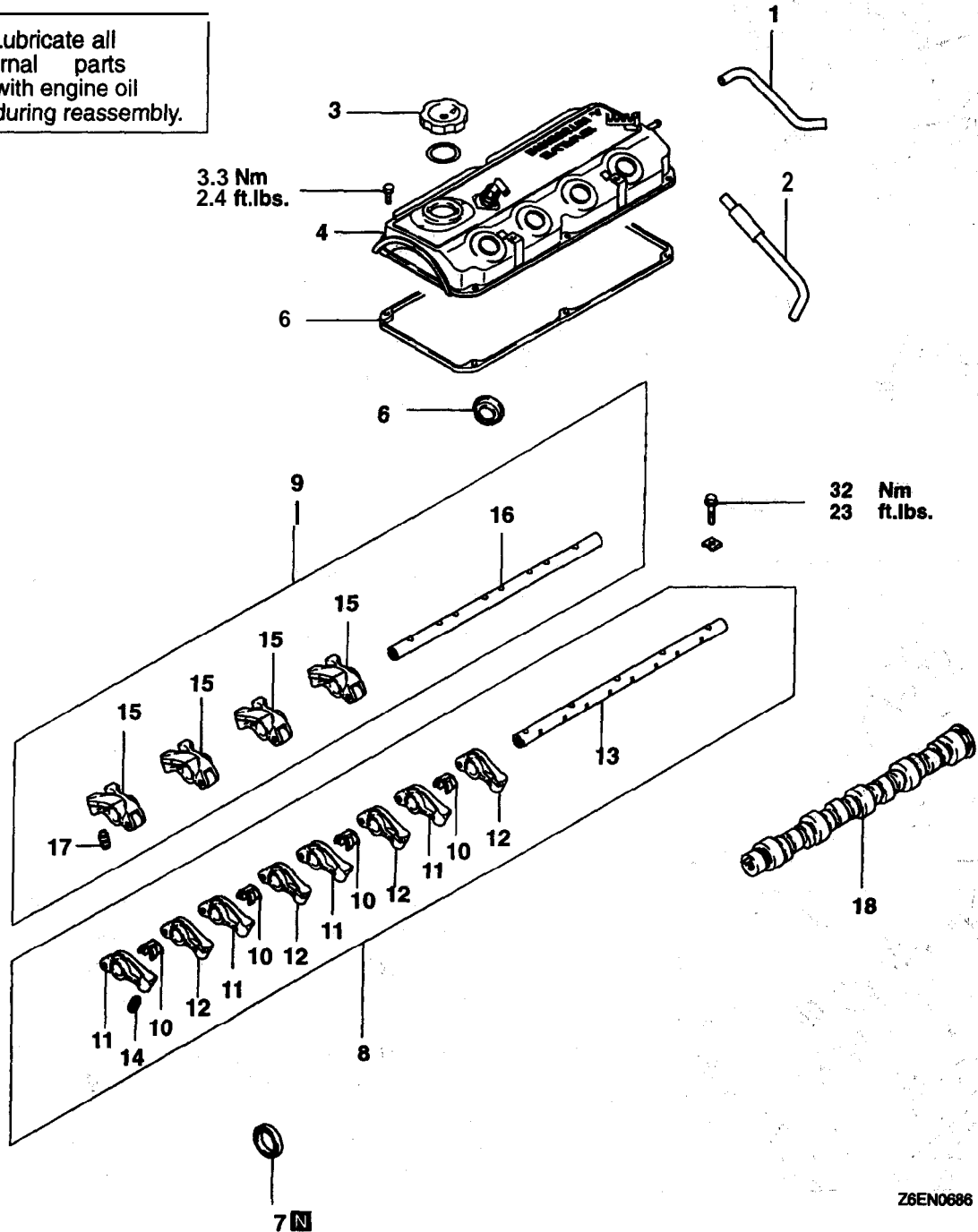
Keep the O-ring free of oil or grease.

ROCKER ARMS AND CAMSHAFT

11300540193

REMOVAL AND INSTALLATION

Lubricate all internal parts with engine oil during reassembly.



Removal steps

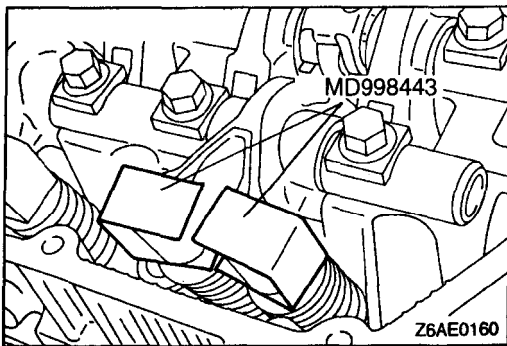
- 1. Breather hose
- 2. P.C.V. hose
- 3. Oil filler cap
- 4. Rocker cover
- 5. Rocker cover gasket
- 6. Oil seal
- 7. Oil seal

- ▶A▶ ▶C▶ 8. Rocker arms and rocker arm shaft
- ▶A▶ ▶B▶ 9. Rocker arms and rocker arm shaft

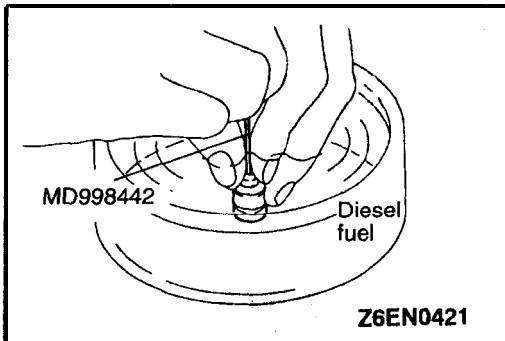
- ▶B▶ 10. Rocker shaft spring
- 11. Rocker arm A
- 12. Rocker arm B
- ▶A▶ 13. Rocker arm shaft (Intake side)
- ▶A▶ 14. Lash adjuster
- 15. Rocker arm C
- ▶A▶ 16. Rocker arm shaft (Exhaust side)
- ▶A▶ 17. Lash adjuster
- 18. Camshaft

TSB Revision

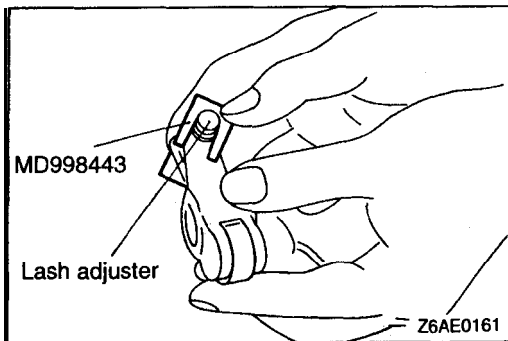
Z6EN0686

**REMOVAL SERVICE POINT****◀A▶ ROCKER ARMS AND ROCKER ARM SHAFTS REMOVAL**

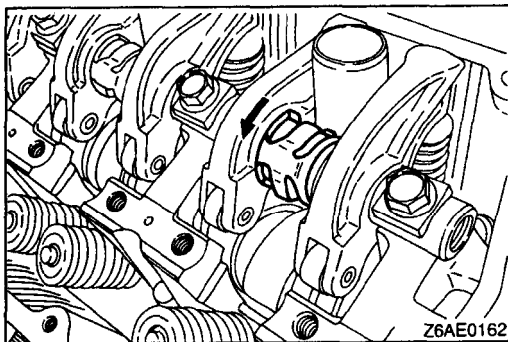
Before removing rocker arms and shafts **assembly**, install the special tool as illustrated to prevent adjuster from dropping.

**INSTALLATION SERVICE POINTS****▶A◀ LASH ADJUSTER INSTALLATION**

- (1) Immerse the' lash adjuster in clean diesel fuel.
- (2) Using a special tool, move the plunger up and down 4 or 5 times while pushing down lightly on the check bail in order to bleed out the air.



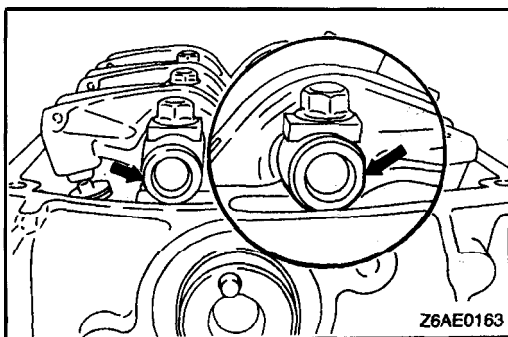
- (3) Insert the lash adjuster to rocker arm, being careful not to spill the diesel fuel. Then use the special tool to prevent adjuster from falling while installing it.

**▶B◀ ROCKER SHAFT SPRING/ROCKER ARMS AND ROCKER ARM SHAFT INSTALLATION**

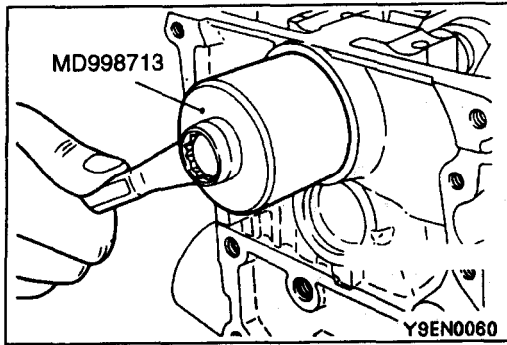
- (1) Temporarily tighten the rocker shaft with the bolt so that all rocker arms on the inlet valve side do not **push the** valves.
- (2) Fit the rocker shaft spring from the above and position it so that it is right angles to the plug **guide**.

NOTE

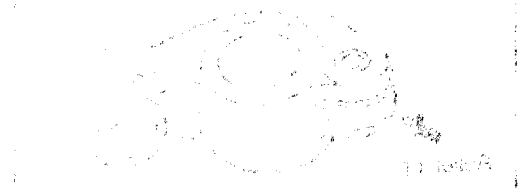
Install the rocker shaft spring before installing the exhaust side rocker arms and 'rocker arm shaft.

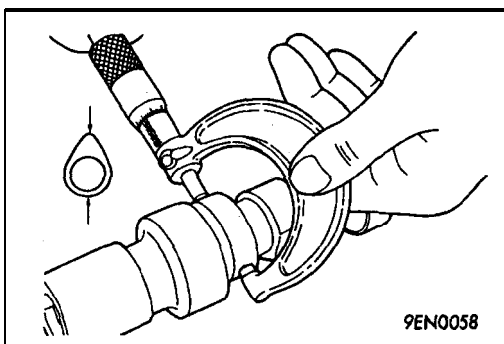


- (3) Remove the special tool for securing the lash adjuster.
- (4) Make sure that the notch in the rocker arm shaft is in the direction as illustrated.



▶C◀ CAMSHAFT OIL SEAL INSTALLATION



**INSPECTION**

11300550189

CAMSHAFT

- (1) Measure the cam height.

Standard value:

Intake 37.39 mm (1.4720 in.)

Exhaust 37.47 mm (1.4752 in.)

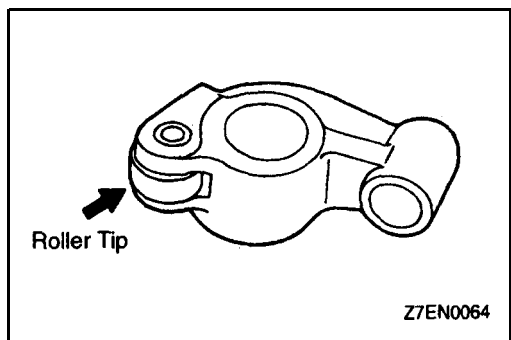
Limit:

Intake 36.69 mm (1.4524 in.)

Exhaust 36.97 mm (1.4655 in.)

NOTE

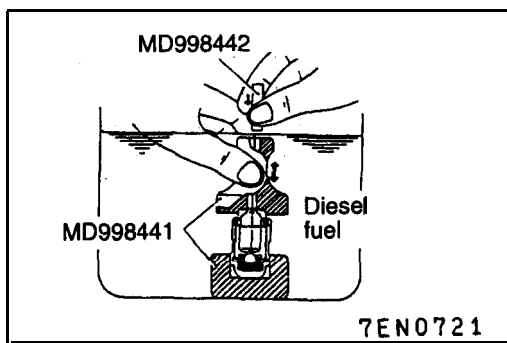
The camshaft identification mark is stamped on the opposite end of the camshaft sprocket side.

**ROCKER ARM**

- (1) Check the roller surface. If any dents, damage or seizure is evident, replace the rocker arm.
- (2) Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- (3) Check the inside diameter. If damage or seizure is evident, replace the rocker arm.

LASH ADJUSTER LEAK-DOWN TEST**Caution**

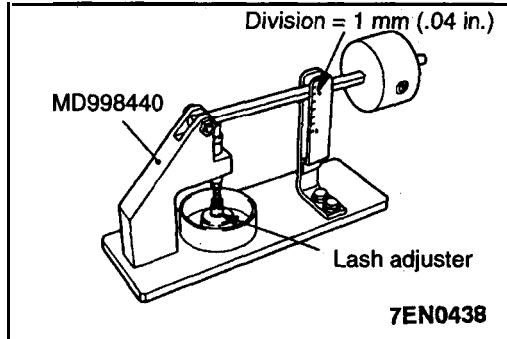
1. The lash adjuster is a precision part. Keep it free from dust and other foreign matter.
2. Do not disassemble lash adjuster.
3. When cleaning lash adjuster, use clean diesel fuel only.



- (1) Immerse the lash adjuster in clean diesel fuel..
- (2) While lightly pushing down inner steel ball using the special tool, move the plunger up and down four or five times to bleed air.
Use of the special tool helps facilitate the air bleeding of the rocker arm mounted type lash adjuster.
- (3) Remove the special tool and press the plunger. If the plunger is hard to be pushed in, the lash adjuster is normal. If the plunger can be pushed in all the way readily, bleed the lash adjuster again and test again. If the plunger is still loose, replace the lash adjuster.

Caution

Upon completion of air bleeding, **hold lash adjuster upright to prevent inside diesel fuel from spilling.**




- (4) After air bleeding, set lash adjuster on the special tool (Leak down tester).
- (5) After plunger has gone down somewhat (.2–.5 mm), measure time taken for it to go down 1. mm. Replace if measured time is out of **specification**.

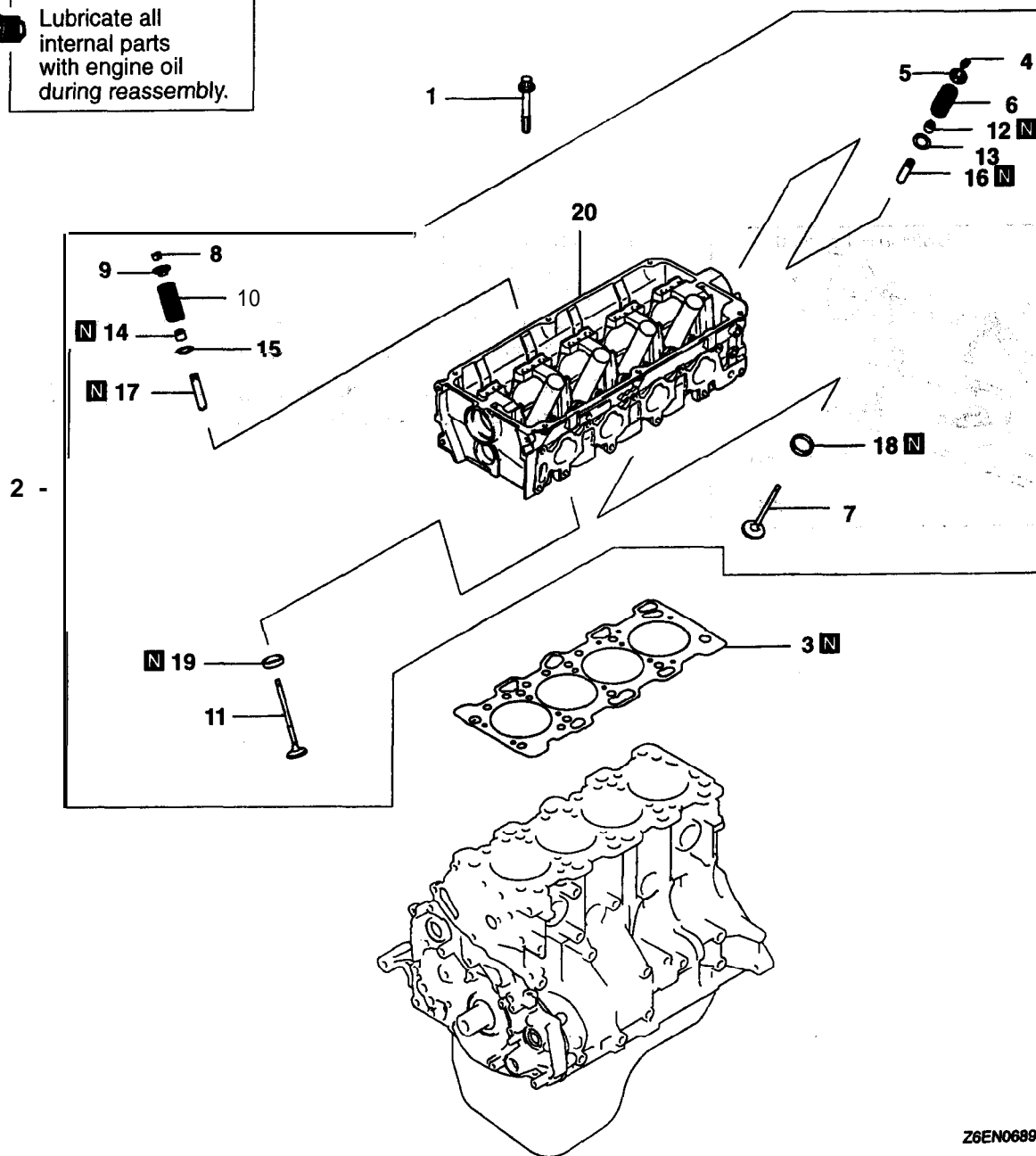
Standard value: 4–20 seconds / 1 mm (.04 in.)
[Diesel fuel at 15–20°C (59–68°F)]

CYLINDER HEAD AND VALVES

11300690195

REMOVAL AND INSTALLATION

 Lubricate all internal parts with engine oil during reassembly.

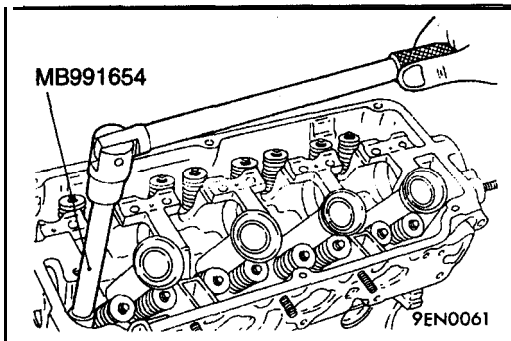


Z6EN0689

Removal steps

- ◀A▶▶E◀ 1. Cylinder head bolt
- ▶D◀ 2. Cylinder head assembly
- ▶D◀ 3. Cylinder head gasket
- ◀B▶▶C◀ 4. Retainer lock
- ▶B◀ 5. Valve spring retainer
- ▶B◀ 6. Valve spring
- ▶B◀ 7. Intake valve
- ◀B▶▶C◀ 8. Retainer lock
- ▶B◀ 9. Valve spring retainer
- ▶B◀ 10. Valve spring

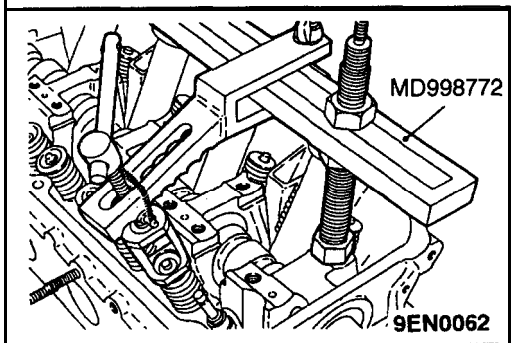
- ii. Exhaust valve
- ◀C▶▶A◀ 12. Valve stem seal
- ◀C▶▶A◀ 13. Valve spring seat
- ◀C▶▶A◀ 14. Valve stem Seal
- 15. Valve spring seat
- 16. Intake valve guide
- 17. Exhaust valve guide
- 18. Intake valve seat
- 19. Exhaust valve seat
- 20. Cylinder head

**REMOVAL SERVICE POINTS****PRECAUTION FOR REMOVED PARTS**

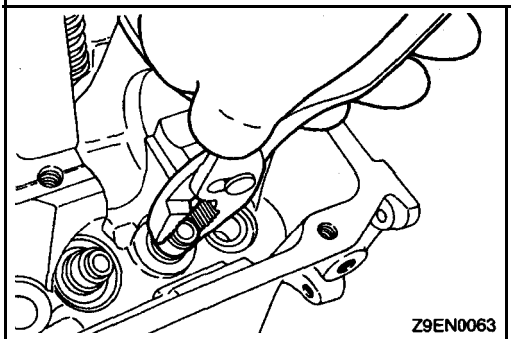
Keep removed parts in order according to the cylinder number and intake/exhaust.

◀A▶ CYLINDER HEAD BOLTS REMOVAL

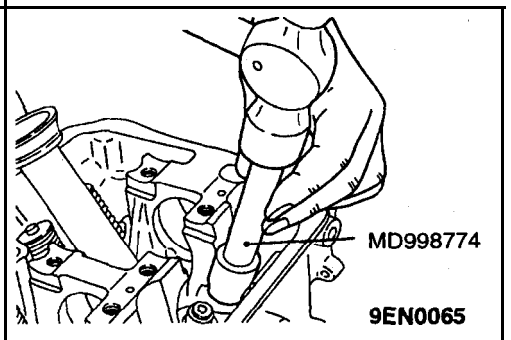
Using the special tool, loosen the cylinder head bolts. Loosen evenly, little by little.

**◀B▶ RETAINER LOCK REMOVAL**

Store removed valves, springs and other parts, tagged to indicate their cylinder No. and location for reassembly.

**◀C▶ VALVE STEM SEAL REMOVAL**

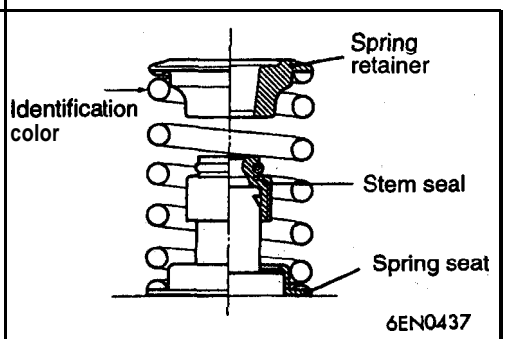
Do not reuse valve stem seal.

**INSTALLATION SERVICE POINTS****▶A◀ VALVE STEM SEAL INSTALLATION**

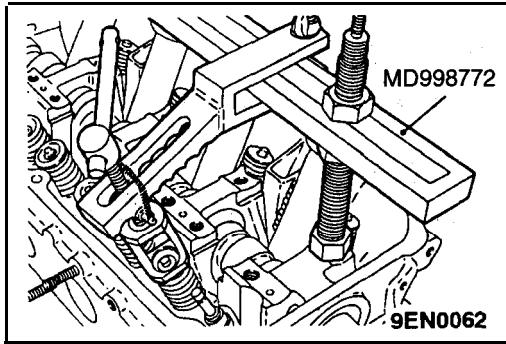
- (1) Install the valve spring seat.
- (2) The special tool must be used to install the valve stem seal. Improper installation could result in oil leaking past the valve guide.

Caution

Do not reuse the valve stem seal.

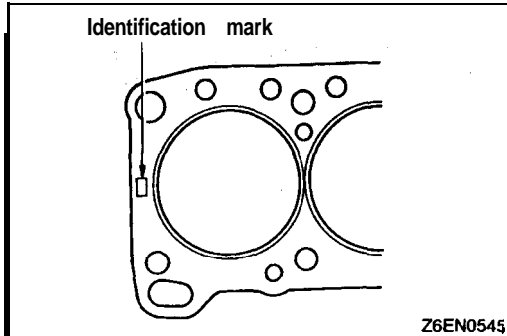
**▶B◀ VALVE SPRINGS INSTALLATION**

Direct the valve spring end with identification color end toward the spring retainer.



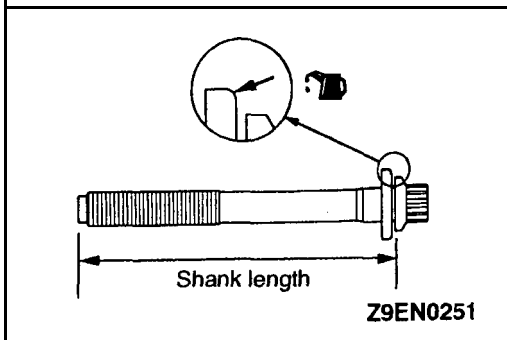
►◀ C RETAINER LOCK INSTALLATION

The valve spring, if excessively compressed, causes the bottom end of retainer to be, in contact, **with**, and **damage**, the stem seal.



►◀ D CYLINDER HEAD GASKET IDENTIFICATION

Identification mark: **4G64N**

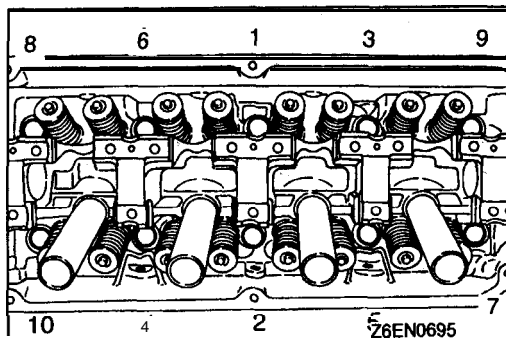


►◀ E CYLINDER HEAD BOLT INSTALLATION

- (1) When installing the cylinder head bolts, check that the shank length of each bolt meets the limit. If the **limit** is exceeded, replace the bolt.

Limit: Max. 99.4 mm (3.91 in.)

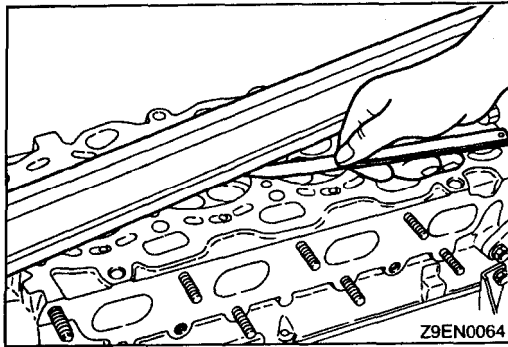
- (2) Apply engine oil to the threaded **portions** of bolts **and** to the washers.



- (3) According to the tightening **sequence**, tighten the bolts to the specified torque **78 Nm (58 ft.lbs.)** using the special tool (**MB991 654**).
- (4) Loosen bolts completely.
- (5) Retighten the loosened bolts to **20 Nm (14.5 ft.lbs.)** in the specified tightening sequence.
- (6) Make a paint mark across each bolt head and cylinder head.
- (7) Give a **90°** turn to the bolts in the **specified** tightening sequence.
- (8) Give another **90°** turn to the bolts and make sure that the paint mark on the, head of each bolt. and that on the **cylinder** head are on **the** same straight line.

Caution

1. If the bolt is turned less than **90°**, **proper fastening performance may not be expected**. When **tightening the bolt, therefore, be careful to give a sufficient turn to it**.
2. If the bolt is overtightened, loosen the bolt completely and then retighten it by repeating the tightening procedure from. step (1).



INSPECTION

11300700218

CYLINDER HEAD

- (1) Check the cylinder head gasket surface for flatness by using a straightedge and thickness gauge.

Standard value: 0.05 mm (.0020 in.)

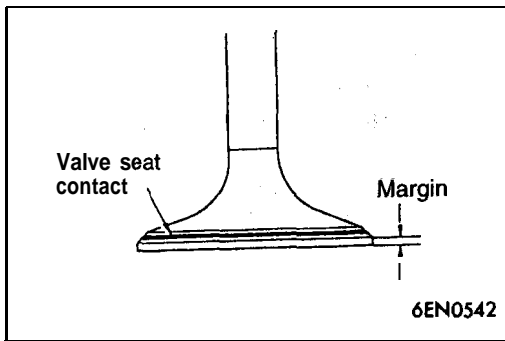
Limit: 0.2 mm (.008 in.)

- (2) If the service limit is exceeded, correct to meet specification.

Grinding limit: • 0.2 mm (.008 in.)

* Includes combined with cylinder block grinding.

**Cylinder head height (Specification when, new):
119.9–120.1 mm (4.720–4.73 in.)**



VALVE

- (1) Check the valve face for correct contact. If incorrect, reface using valve refacer. Valve seat contact **should** be maintained uniform at the center of valve face.
- (2) If the margin exceeds the service limit, **replace the** valve.

Standard value:

Intake 1.0 mm (0.39 in.)

Exhaust 1.2 mm (.047 in.)

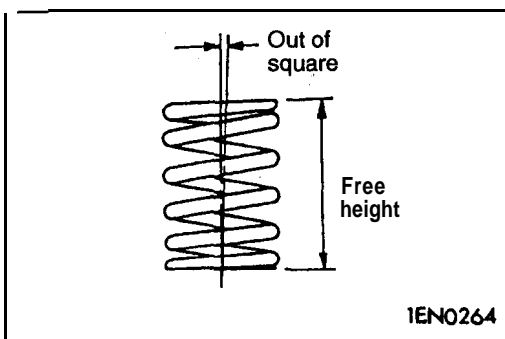
Limit:

Intake 0.5 mm (.020 in.)

Exhaust 0.7 mm (.028 in.)

- (3) Measure the valve's total length. If the measurement is less than specified, replace the valve.

item	Standard value mm (in.)	Limit mm (in.)
Intake	112.30 (4.4213)	111.80 (4.4016)
Exhaust	114.11 (4.4925)	113.61 (4.4728)



VALVE SPRING

- (1) Measure the free height of spring and, if it is smaller than the limit, replace.

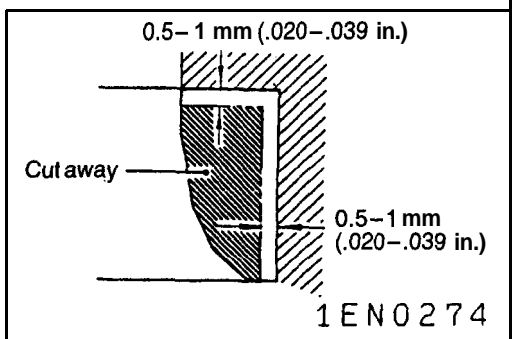
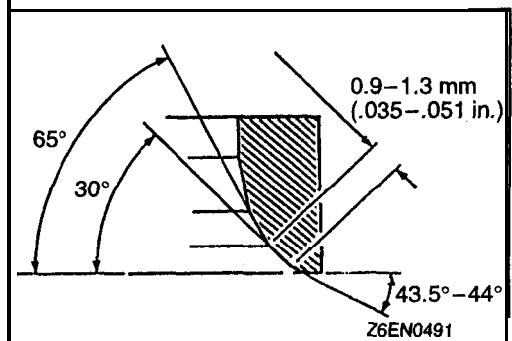
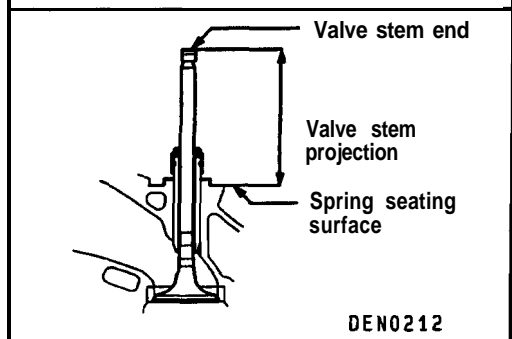
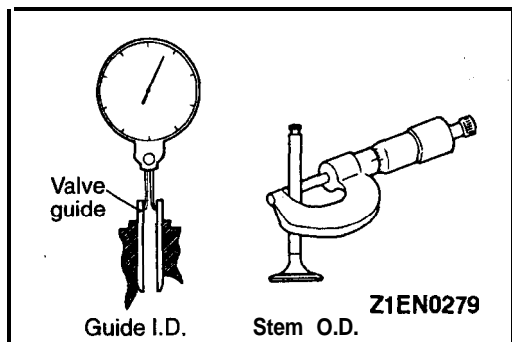
Standard value: 51.0 mm (2.008 in.)

Limit: 50.0 mm (1.969 in.)

- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value: 2° or less

Limit: Max. 4°



VALVE GUIDE

- (1) Measure the clearance between the valve guide and valve stem. If the limit is exceeded, replace the valve guide or valve, or both.

Standard value:

Intake 0.02–0.05 mm (.0008–.0020 in.)

Exhaust 0.03–0.07 mm (.0012–.0028 in.)

Limit:

Intake 0.10 mm (.0039 in.)

Exhaust 0.15 mm (.0059 in.)

VALVE SEAT

- (1) Assemble the valve, then measure the valve stem projection between the end of the valve stem and the spring seating surface. If the measurement exceeds the specified limit, replace the valve seat.

Standard value: 49.30 mm (1.9409 in.)

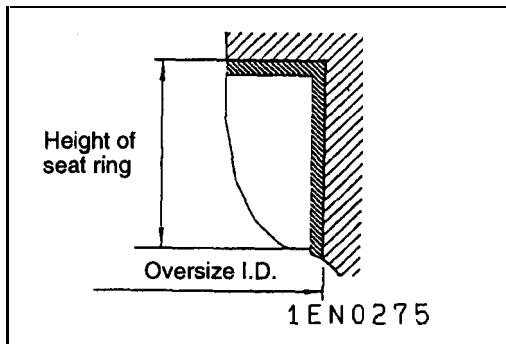
Limit: 49.80 mm (1.9606 in.)

VALVE SEAT RECONDITIONING PROCEDURE

- (1) Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
- (2) Using the seat grinder, correct to obtain the specified seat width and angle.
- (3) After correcting the valve seat, lap the valve and valve seat using lapping compound. Then, check the valve stem projection (refer to VALVE SEAT in INSPECTION).

VALVE SEAT REPLACEMENT PROCEDURE

- (1) Cut the valve seat to be replaced from the inside to thin the wall thickness. Then, remove the valve seat.



- (2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

Intake seat ring hole diameters'

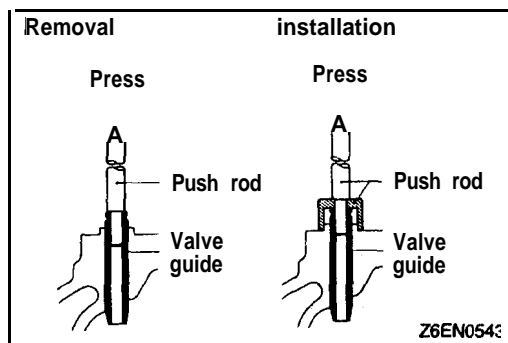
0.3 O.S.	34.30–34.33 mm (1.3504–1.3516 in.)
0.6 O.S.	34.60–34.63 mm (1.3622–1.3634 in.)

Exhaust seat ring hole diameters

0.3 O.S.	31.80–31.83 mm (1.2520–1.2531 in.)
0.6 O.S.	32.10–32.13 mm (1.2638–1.2650 in.)

- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.

- (4) Using a valve seat cutter, correct the valve seat to the specified width and angle.
See "VALVE SEAT RECONDITIONING PROCEDURE".



VALVE GUIDE REPLACEMENT PROCEDURE

- (1) Using the push rod and a press, remove the valve guide toward cylinder head gasket surface.
- (2) Rebore valve guide hole to the new oversize valve guide outside diameter.

Valve guide hole diameters

0.05 O.S.	11.05–11.07 mm (.4350–.4358 in.)
0.25 O.S.	11.25–11.27 mm (.4429–.4437 in.)
0.50 O.S.	11.50–11.52 mm (.4528–.4535 in.)


NOTE

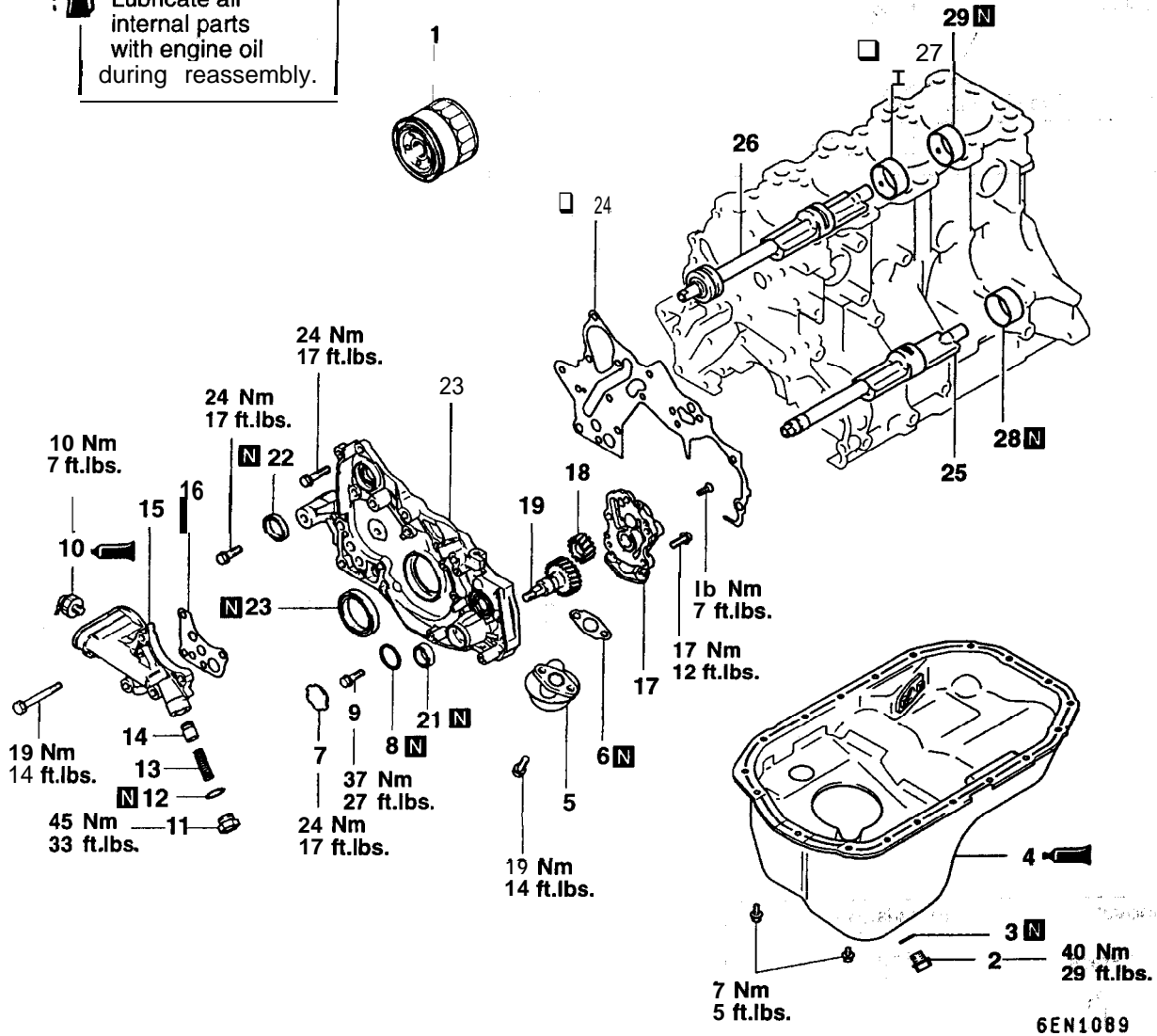
Do not install a valve guide of the same size **again**.

- (3) Using the special tool, press-fit the valve guide, working from the cylinder head top surface.
- (4) After installing valve guides, insert new valves in them to check for sliding condition.
- (5) When valve guides have been replaced, check for valve contact and correct valve seats as **necessary**.

FRONT CASE, COUNTERBALANCE SHAFT AND OIL PAN 11300720085

REMOVAL AND INSTALLATION

 Lubricate all internal parts with engine oil during reassembly.



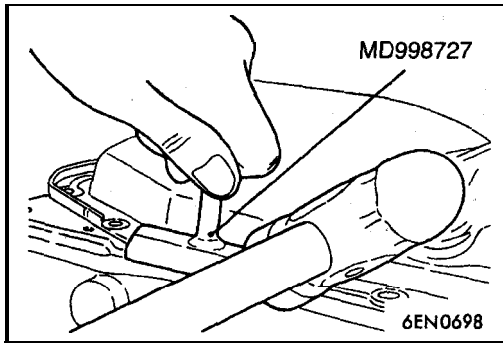
6EN1089

Removal steps

- ▶N◀ 1. Oil filter
- ▶M◀ 2. Drain plug
- ◀A▶▶L◀ 3. Drain plug gasket
- ▶K◀ 4. Oil pan
- ▶J◀▶I◀ 5. Oil screen
- ▶B▶▶K◀ 6. Oil screen gasket
- ▶C▶▶J◀▶I◀ 7. Plug
- ▶I◀▶K◀ 8. O-ring
- ▶I◀▶K◀ 9. Flange bolt
- ▶I◀▶K◀ 10. Oil pressure switch
- ▶I◀▶K◀ 11. Relief plug
- ▶I◀▶K◀ 12. Gasket
- ▶I◀▶K◀ 13. Relief spring
- ▶I◀▶K◀ 14. Relief plunger
- ▶I◀▶K◀ 15. Oil filter bracket
- ▶I◀▶K◀ 16. Oil filter bracket gasket

- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 17. Oil pump cover
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 18. Oil pump driven gear
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 19. Oil pump drive gear
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 20. Crankshaft front oil seal
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 21. Oil pump oil seal
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 22. Counterbalance shaft oil seal
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 23. Front case
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 24. Front case gasket
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 25. Counterbalance shaft, left
- ▶H▶▶H▶▶G▶▶F▶▶E▶▶D▶ 26. Counterbalance shaft, right
- ▶D▶▶C▶▶E▶▶B▶▶A▶ 27. Counterbalance shaft, front bearing
- ▶D▶▶C▶▶E▶▶B▶▶A▶ 28. Counterbalance shaft, rear bearing, left
- ▶D▶▶C▶▶E▶▶B▶▶A▶ 29. Counterbalance shaft, rear bearing, right

TSB Revision



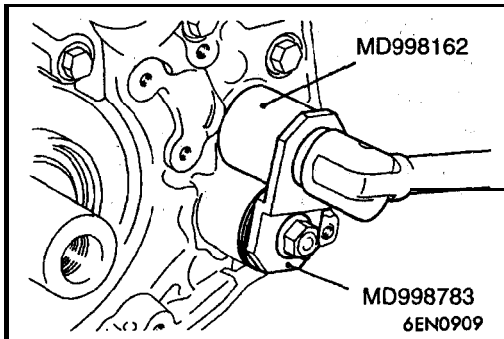
REMOVAL SERVICE POINTS

◀A▶ OIL PAN REMOVAL

- (1) Remove all oil pan bolts.
- (2) Drive in the special tool **between** the cylinder, block and oil pan.

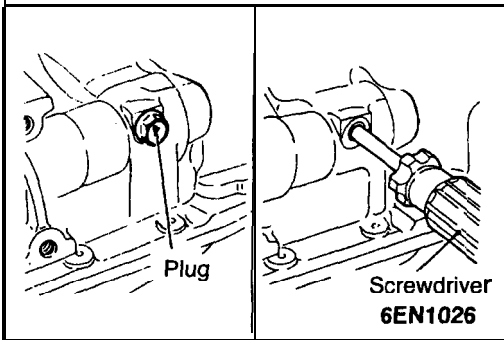
NOTE

Never use a screwdriver or chisel, instead **of the** service tool, as a deformed oil pan **flange** will result in oil leakage.



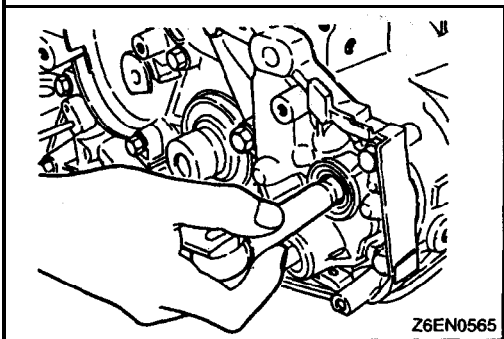
◀B▶ PLUG REMOVAL

If the plug is too tight, hit the plug head with a hammer two to three times, and the plug will be easily loosened.

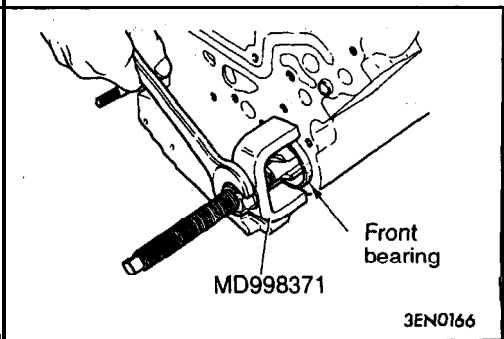


◀C▶ FLANGE BOLT REMOVAL

- (1) Remove the plug on the side of **cylinder** block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.32 in.)] into the plug hole, to lock the counterbalance shaft.



- (3) Loosen the flange bolt.

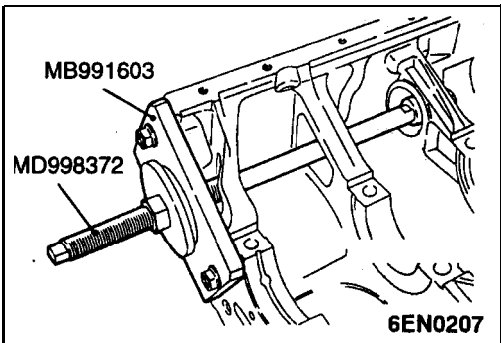


◀D▶ COUNTERBALANCE SHAFT FRONT BEARING REMOVAL

Using the special tool, remove the **counterbalance** shaft front bearing from the cylinder block.

NOTE

Be sure to remove the front bearing **first**. If it has not been removed, the Rear Bearing Puller cannot be used.

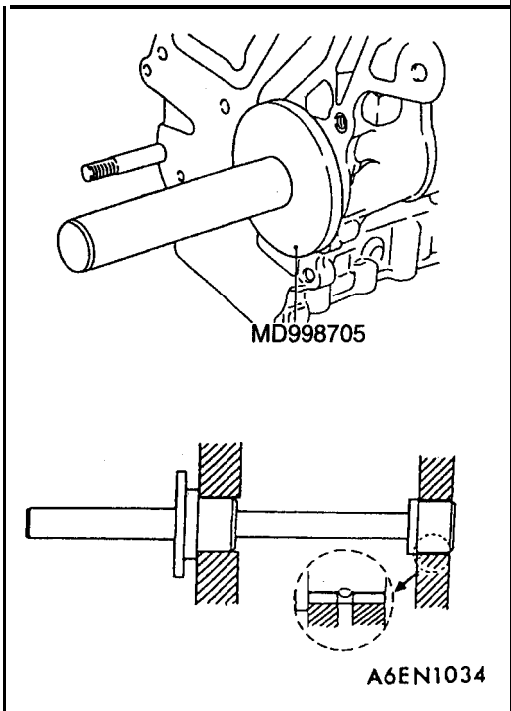


◀E▶ COUNTERBALANCE SHAFT REAR BEARING REMOVAL

Using the special tool, remove the left counterbalance shaft rear bearing from the cylinder block.

NOTE

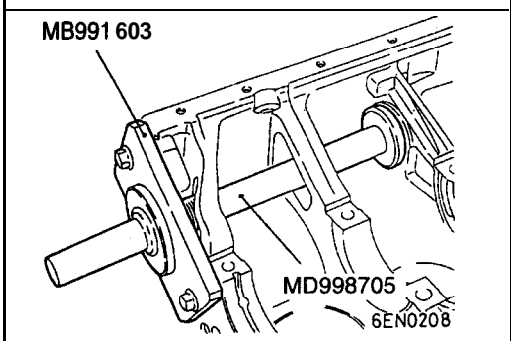
When removing the left counterbalance shaft rear bearing, install the special tool (MB991603) in front of the **cylinder** block.



INSTALLATION SERVICE POINTS

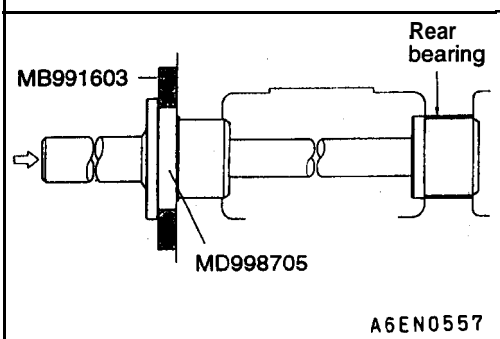
▶A◀ RIGHT COUNTERBALANCE SHAFT REAR BEARING INSTALLATION

- (1) Apply engine oil to the outer surface of bearing.
- (2) Using special tools, install right rear bearing. Make sure that oil hole of bearing is aligned with oil hole of cylinder block.



▶B◀ LEFT COUNTERBALANCE SHAFT REAR BEARING INSTALLATION

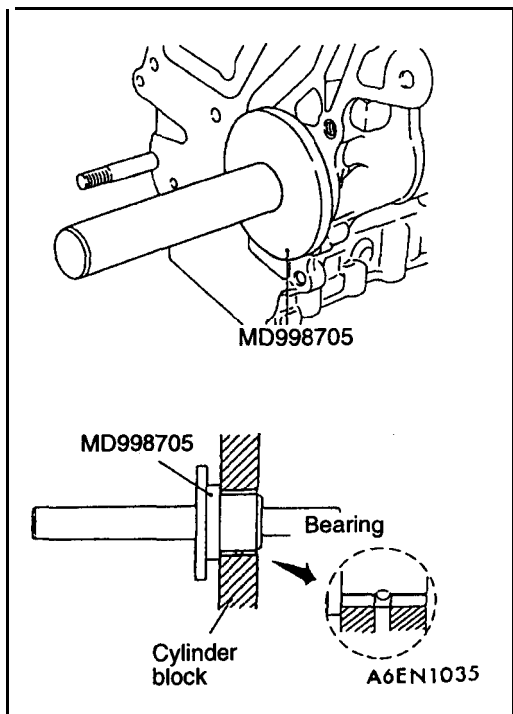
- (1) Install the special tool (GUIDE PLATE) tool to the **cylinder** block.
- (2) Apply engine oil to the rear bearing outer **circumference** and bearing hole in cylinder block.



- (3) Using the special tool, install the rear bearing..

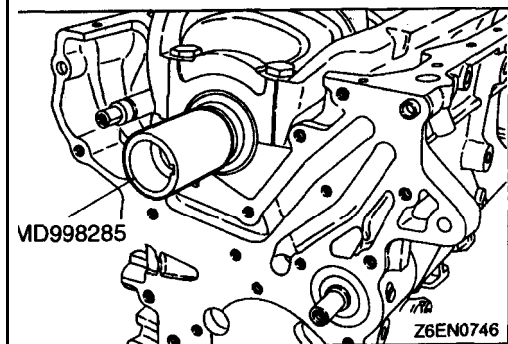
NOTE

The left rear bearing has no oil holes.



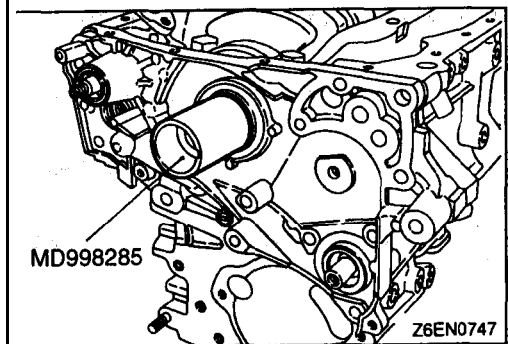
►C◄ COUNTERBALANCE SHAFT FRONT BEARING INSTALLATION

Using special tools, install front bearing,

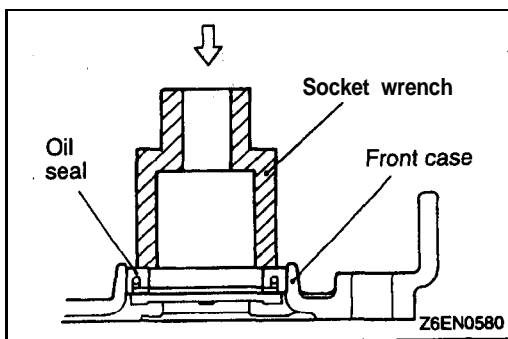


►D◄ FRONT CASE INSTALLATION

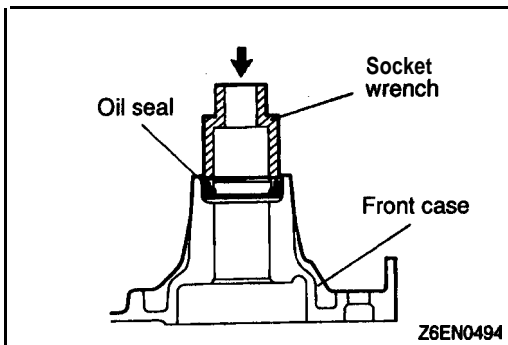
- (1) Set the special tool on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.



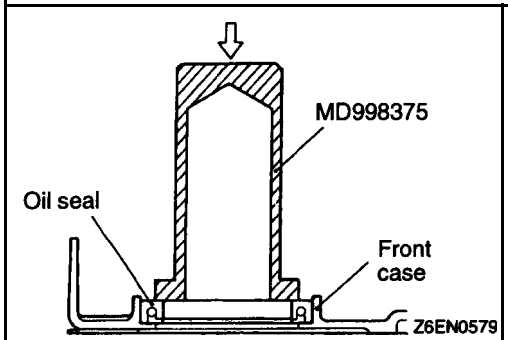
- (2) Install the front case assembly through a new front case gasket and temporarily tighten, the flange bolts (other than those for tightening the filter bracket).



►E◄ COUNTERBALANCE SHAFT OIL SEAL INSTALLATION

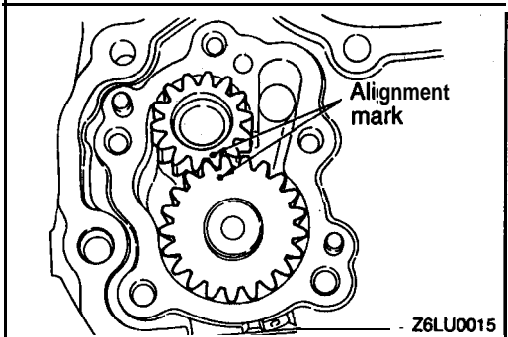


►F◄ OIL PUMP OIL SEAL INSTALLATION



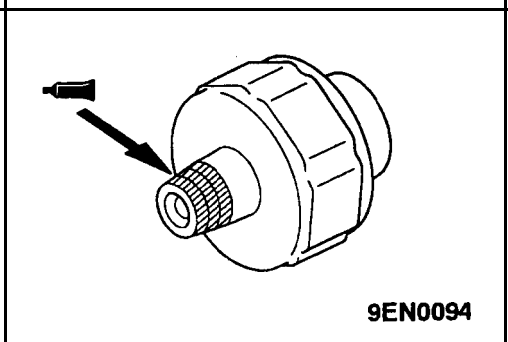
►G◄ CRANKSHAFT FRONT OIL SEAL INSTALLATION

Using the special tool, install the crankshaft front oil seal into the front case.



►H◄ OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR INSTALLATION

Apply engine oil to the gears and line up the alignment marks.



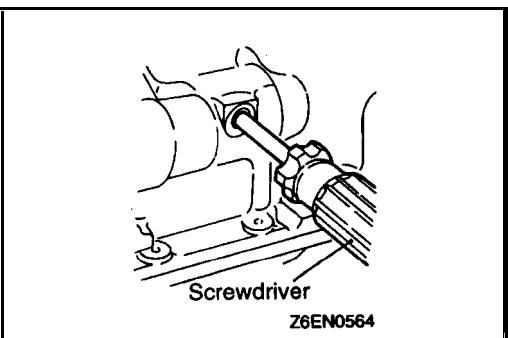
►I◄ SEALANT APPLICATION TO OIL PRESSURE SWITCH

Coat the threads of switch with sealant and install the switch using the special tool.

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

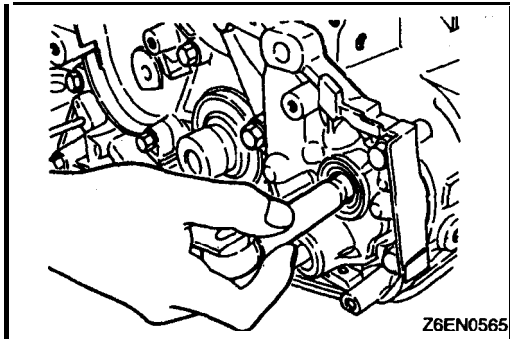
Caution

1. Keep the end of threaded portion clear of sealant. ,
2. Avoid an overtightening.

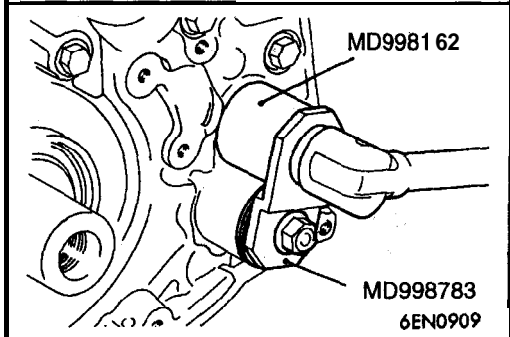


►J◄ FLANGE BOLT INSTALLATION

- (1) Insert a Phillips screwdriver into a hole in the left side of the cylinder block to lock the silent shaft.

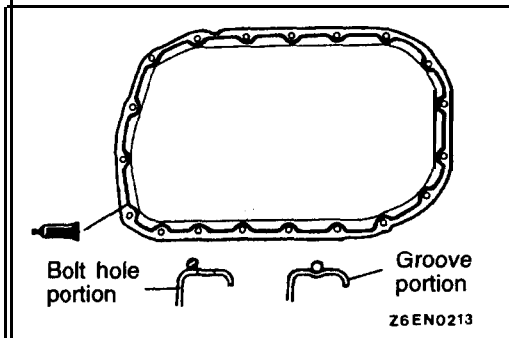


- (2) Secure the oil pump driven gear onto the left counterbalance shaft by tightening the flange bolt to specified torque.



►K◄ PLUG INSTALLATION

- (1) Install a new O-ring to the **groove** of front case.
- (2) Using the special tool, **install the plug** and tighten to specified torque.



►L◄ OIL PAN INSTALLATION

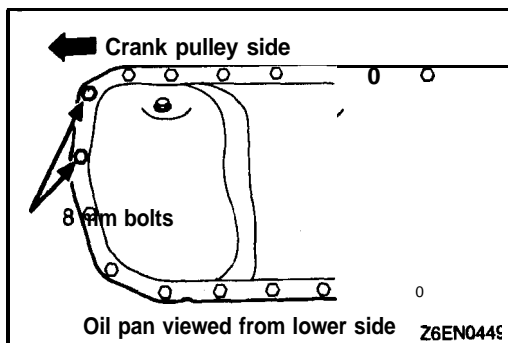
- (1) Clean both mating surfaces of oil pan and cylinder block.
- (2) Apply a 4 mm (.16 in.) wide bead of sealant to the entire circumference of the oil pan flange.

Specified sealant:

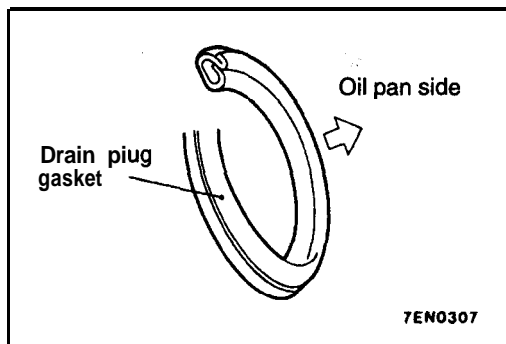
MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE

- (1) Be sure to install the oil pan quickly while the sealant is wet (within 15 minutes).
- (2) After installation, keep the sealed area **away** from the oil and coolant for approx. **one** hour.

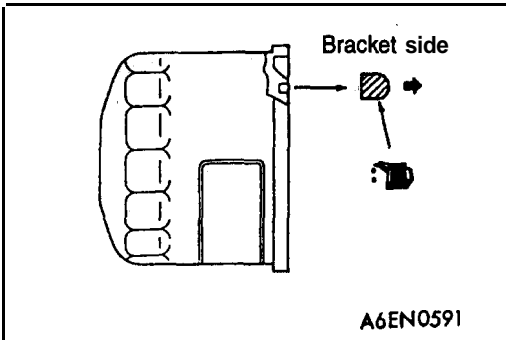


- (3) Note the difference in bolt lengths at the location shown.



►◄ DRAIN PLUG GASKET INSTALLATION

Install the drain plug gasket in the shown direction.



►◄ OIL FILTER INSTALLATION

- (1) Clean the installation surface of the filter bracket.
- (2) Apply engine oil to the O-ring of the oil filter.
- (3) Screw the oil filter in until the O-ring contacts the bracket. Then tighten $3/4$ turn [tightening torque: 17 Nm (12, ft.lbs)].

NOTE

For MD1 35737, tighten one turn [Tightening torque: 14 Nm (10 ft.lbs.)] after the O-ring contacts the bracket.

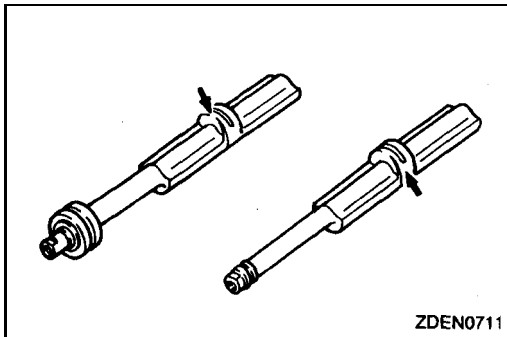
INSPECTION

FRONT CASE

- (1) Check oil holes for clogging and -clean if necessary.
- (2) Check left counterbalance shaft front bearing section for wear, damage and seizure. If there is anything 'wrong with the section, replace the front case.
- (3) Check the front case for cracks and other 'damage. Replace cracked or damaged front case.

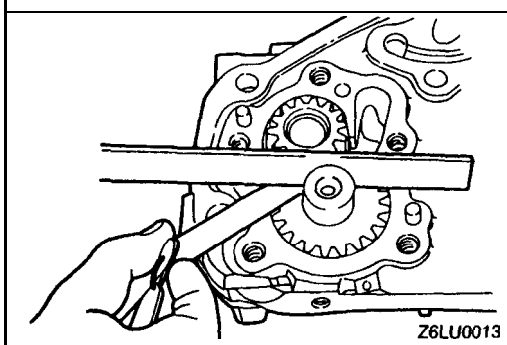
OIL SEAL

- (1) Check the oil seal lip for wear and damage. **Replace** oil seal if necessary.
- (2) Check the oil seal lip for deterioration. Replace oil seal if necessary.



COUNTERBALANCE SHAFT

- (1) Check oil holes for clogging.
- (2) Check journal for seizure, damage and contact with bearing. If there is anything wrong with the journal, replace counterbalance shaft, bearing or front case assembly.



OIL PUMP

- (1) Assemble the-oil pump gear to the front case and rotate it to ensure smooth rotation with no looseness.
- (2) Ensure that there is no ridge wear on the contact surface between the front case and the gear surface of the oil pump cover,
- (3) Check the side clearance


Standard value:

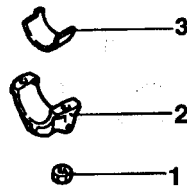
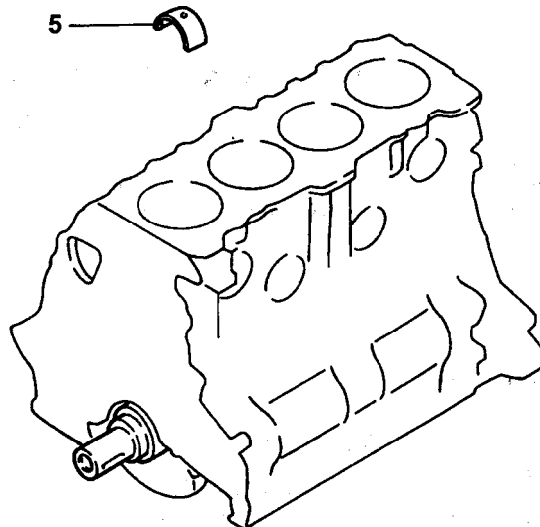
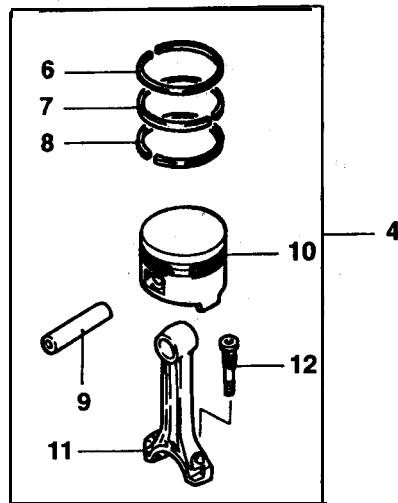
Drive gear	0.08–0.14 mm (.0031–.0055 in.)
Driven gear	0.06–0.12 mm (.0024–.0047 in.)

PISTON AND CONNECTING ROD

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REMOVAL AND INSTALLATION







 Lubricate all internal parts with engine oil during reassembly.



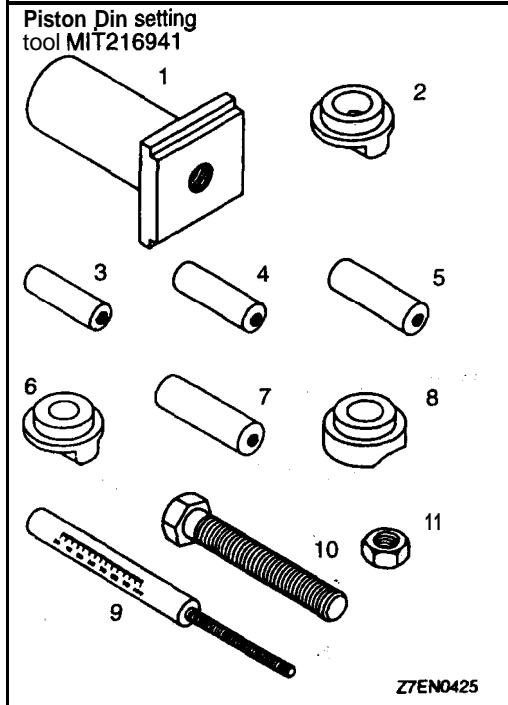
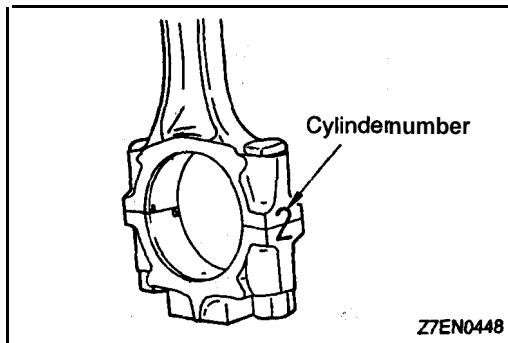
Z6EN0526

Removal steps

-  1. Nut
-  2. Connecting rod cap
-  3. Connecting rod bearing
-  4. Piston and connecting rod assembly
-  5. Connecting rod bearing
-  6. Piston ring No. 1

-  7. Piston ring No. 2
-  8. Oil ring
-  9. Piston pin
-  10. Piston
-  11. Connecting rod
-  12. Bolt

TSB Revision



REMOVAL SERVICE POINTS

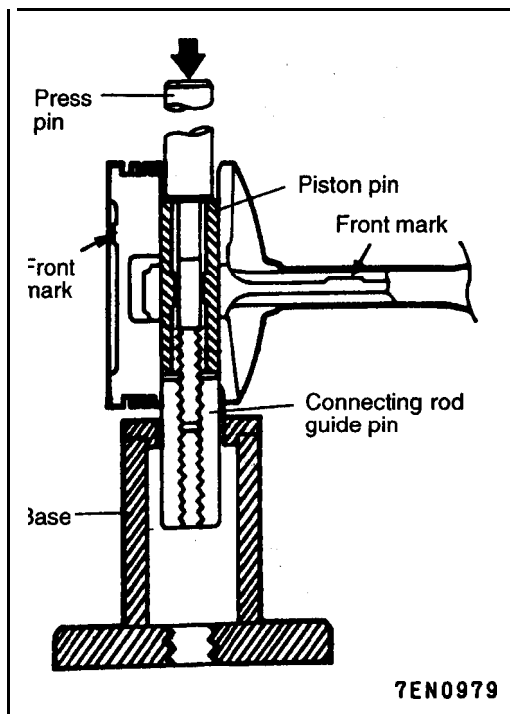
◀A▶ CONNECTING ROD CAP REMOVAL

- (1) Mark the cylinder number on the side of the connecting rod big end for correct reassembly.
- (2) Keep the removed connecting rods, caps, and bearings in order according to the cylinder number.

◀B▶ PISTON PIN REMOVAL

Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48143	Press Pin
10	216943	Stop Screw
11	10396	Nut

- (1) Remove the stop screw from the base.
- (2) Select the correct piston support for your application (See above). Fit the piston support onto the base. Place the base on press support blocks.



- (3) Insert the press pin through the piston pin hole. Select the correct connecting rod guide pin (See above). Thread the guide pin onto the threaded portion of the press pin.
- (4) Position the piston assembly on the piston support in the press. With the press pin up as shown in Figure 4, insert the guide pin through the hole in the piston and through the hole in the piston support.
- (5) Press the piston pin out of the assembly.

IMPORTANT: To avoid piston damage,

- The piston support must seat squarely against the piston.
- Verify that the piston pin will slide through the hole in the piston support.

- (6) Remove the piston pin from the press pin.

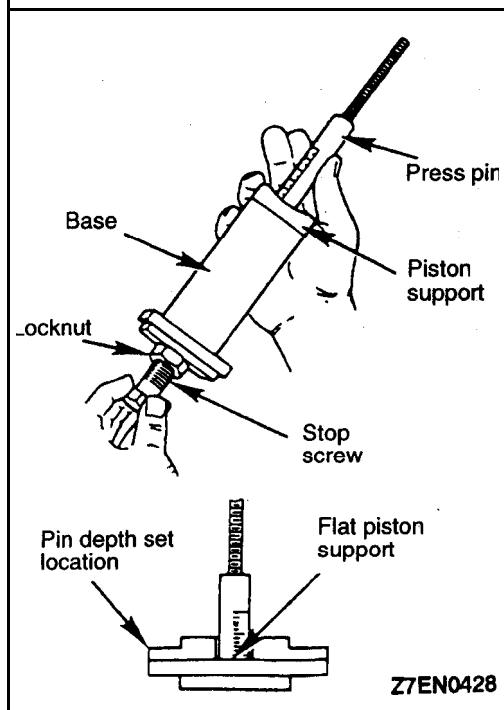
INSTALLATION SERVICE POINTS

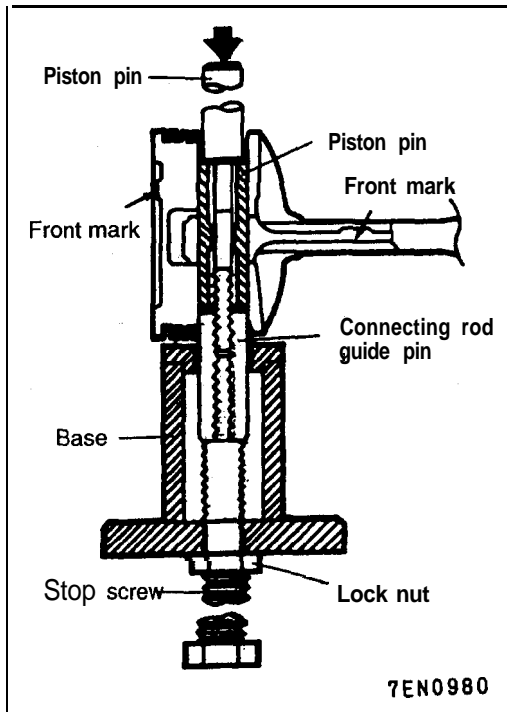
▶◀ PISTON PIN INSTALLATION

- (1) Thread the stop screw and lock nut assembly into the base. Fit the correct piston support on top of the base. Insert the press pin, threaded end up, into the hole in the piston support until the press pin touches the stop screw.
- (2) Using the markings on the press pin, adjust the stop screw to the depth as shown below:

Depth:

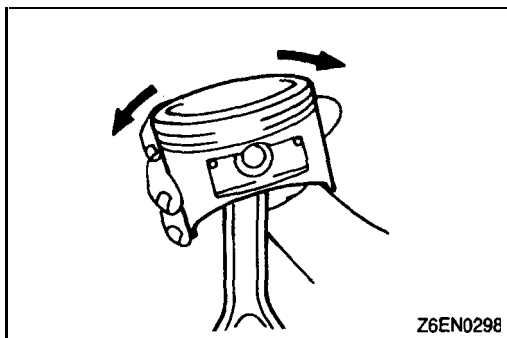
Refer to the operating instructions on the special tool.



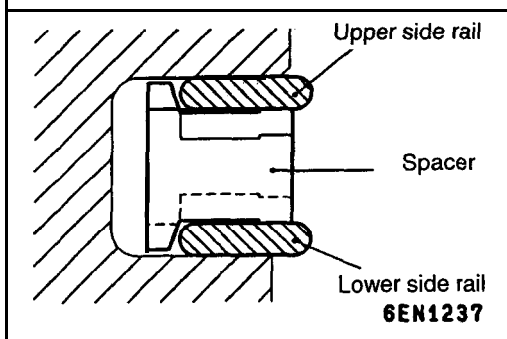


- (3) Place the base on **press support blocks**.
- (4) Slide the piston pin over the **threaded end** of the press pin, and thread the correct **guide pin up against it**.
- (5) Coat the piston pin with oil, and with the **connecting rod** held in position, slide the guide pin through the piston and connecting rod.
- (6) Press the piston pin **through** the connecting rod until the guide pin contacts the stop screw.
- (7) Remove the piston assembly from the base. Remove the guide pin and press pin from the assembly.

IMPORTANT: Due to production tolerance variations, it is necessary to visually inspect the piston **pin** depth after installation to verify that the piston pin is centered. Adjust if necessary.



- (8) Check that the piston moves smoothly.



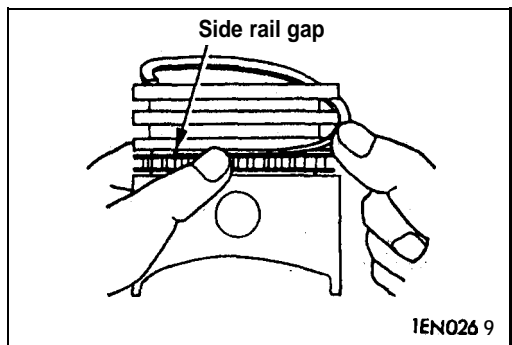
▶B◀ OIL RING INSTALLATION

- (1) Fit the oil ring spacer into the piston ring **groove**.

NOTE

1. The side rails and spacer may be installed in either direction.
2. New spacers and side rails are colored for identification of their sizes.

Size	Identification color
Standard	None
0.50 mm oversize	Blue
1.00 mm oversize	Yellow



(2) **Install** the upper side rail.

To install the side rail, first fit one **end of** the rail into the piston groove, then press the remaining portion into position by finger. See illustration.

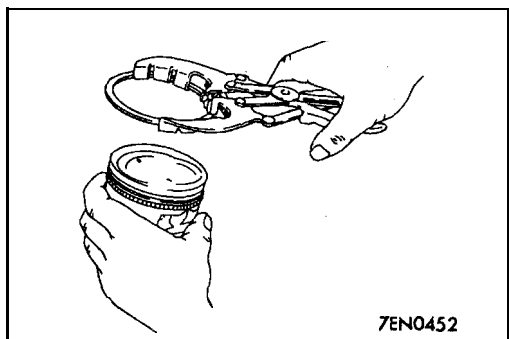
Use of ring expander to **expand** the side rail end gap can break the side rail, unlike other **piston rings**.

Caution

Do not use piston ring expander when installing side rail.

(3) Install the lower side rail in the **same procedure** as described in step (2).

(4) Make sure that the side rails move smoothly in either direction.



►C◄ PISTON RING NO. 2 / PISTON RING NO. 1 INSTALLATION

Using piston ring expander, fit No. 2 and then **No. 1** piston ring into position.

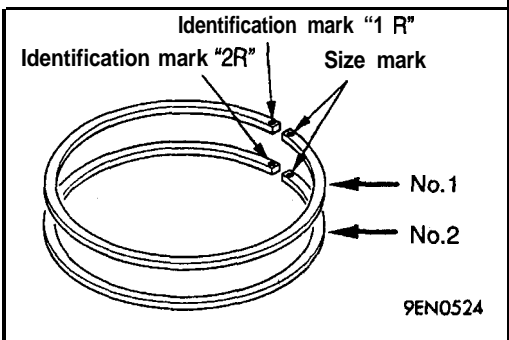
NOTE

1. The ring end is provided with **identification** mark.

Identification mark:

No.1 ring 1R

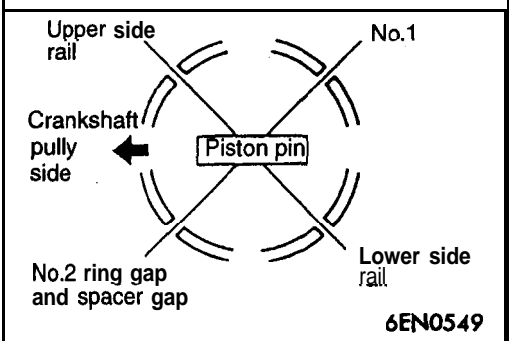
No.2 ring 2R



2. Install piston rings with identification mark facing up, to the piston crown side.

3. Size marks on piston rings are as follows..

Size	Size mark
Standard	NONE
0.50 mm oversize	50
1.00 mm oversize	100

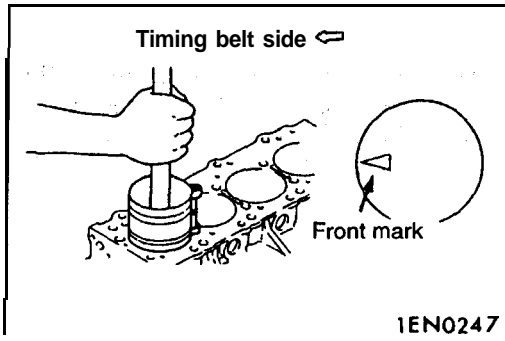


►D◄ PISTON AND CONNECTING ROD INSTALLATION

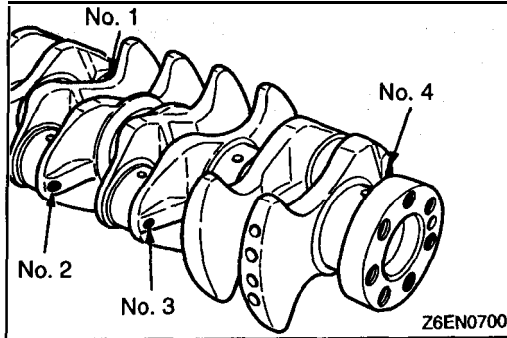
(1) Liberally coat engine oil on the circumference of the piston, piston ring, and oil ring.

(2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the figure.

(3) Rotate crankshaft so that crank pin is on center of cylinder bore.



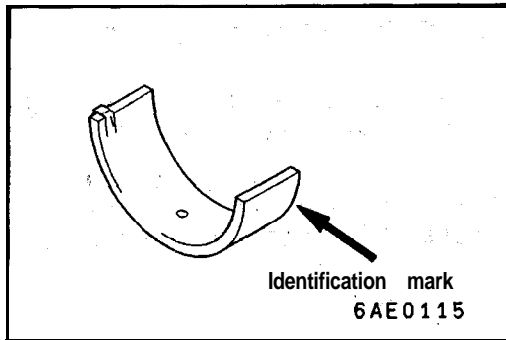
- (4) Use suitable thread protectors on the connecting rod bolts before inserting piston and connecting rod assembly into the cylinder block.
Care must be taken not to nick the crank pin.
- (5) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.



CONNECTING ROD BEARINGS INSTALLATION

When the bearing needs replacing, select and install a proper bearing by the following procedure.

- (1) Measure the crankshaft pin diameter and confirm its classification from the following table. In the case of a crankshaft supplied as a service part, identification colors of its pins are painted at the positions shown in the illustration.



- (2) The connecting rod bearing identification mark is stamped at the position shown in the illustration.

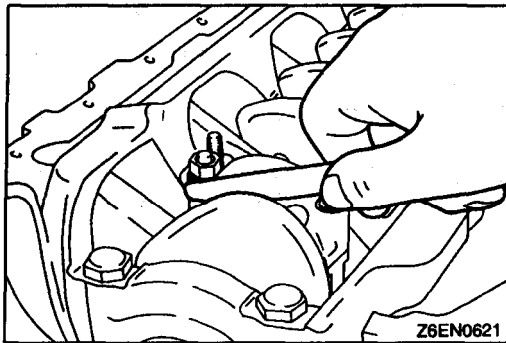
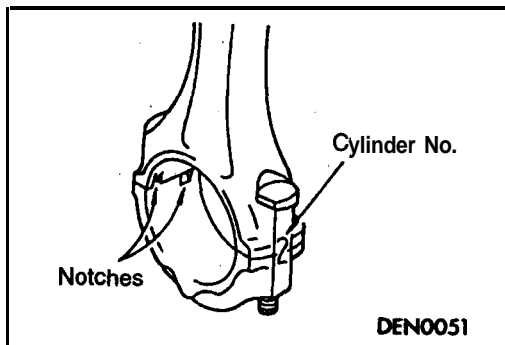
Crankshaft pin				Connecting rod bearing	
Classification	Identification mark	Identification color	O.D. mm (in.)	Identification mark	Thickness mm (in.)
	Production part	Service part			
1	None	Yellow	44.995–45.000 (1.7715–1.7717)	1	1.478–1.491 (0.0582–0.0587)
2	None	None	44.985–44.995 (1.7711–1.7715)	2	1.491–1.495 (0.0587–0.0589)
3	None	White	44.980–44.985 (1.7709–1.7711)	3	1.495–1.499 (0.0589–0.0590)

Connecting rod I.D.: 48.000–48.015 mm (1.8900–1.8904 in.)

- (3) Select a proper bearing from the above table on the basis of the identification data confirmed under Items (1) and (2).

[Example]

- (1) If the measured value of a crankshaft pin outer diameter is between 44.995 and 45.000 mm (1.7715 and 1.7717 in.), the pin is classified as “1” in the table. In case the crankshaft is also replaced by a spare part, check the identification colors of the pins painted on the new crankshaft. If the color is yellow, for example, the pin is classified as “1”. In the above cases, select the connecting rod bearing having identification mark “1”.



►F◄ CONNECTING ROD CAP INSTALLATION

- (1) Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches come on the same side as shown.

- (2) Make sure that the connecting rod big end side clearance meets the specification.

Standard value: 0.10–0.25 mm (.0039–.0098 in.)

Limit: 0.4 mm (.016 in.)

►G◄ CONNECTING ROD CAP NUT INSTALLATION

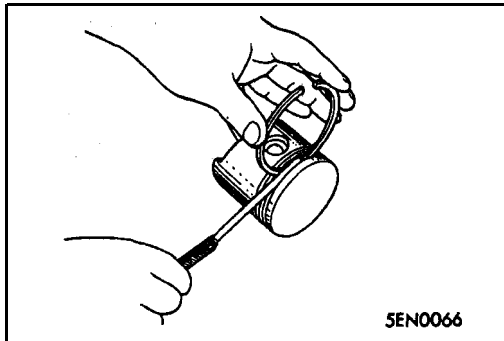
NOTE

Installation of the connecting rod nut should be **performed** with the cylinder head or the spark plug removed.

- (1) Since the connecting rod bolts and nuts are torqued using the plastic area tightening method, the bolts should be examined **BEFORE** reuse. If **the bolt** threads are “necked down”, the bolt should be replaced.
Necking can be checked by running a nut with fingers to the full length of the bolt threads. If the nut does not run down smoothly, the bolt should be replaced.
- (2) Before installation of each nut, apply engine oil to the threaded portion and bearing surface of the nut.
- (3) Loosely tighten each nut to the bolt.
- (4) Then tighten the nuts alternately to a torque of 20 Nm (14.5 ft.lbs.) to install the cap properly.
- (5) Make a paint mark on the head of each nut.
- (6) Make a **paint** mark on the bolt end at the position **90°** to **100°** from the paint mark made on the nut in the direction of **tightening** the nut.
- (7) Give a **90°** to **100°** turn to the nut and make sure that the paint mark on the nut and that on the bolt are in alignment.

Caution

1. If the nut is turned less than **90°**, proper fastening performance may not be expected. When **tightening** the nut, therefore, be careful to give a sufficient turn to it.
2. If the nut is **overtightened** (exceeding **100°**), loosen the nut completely and then retighten it by repeating the tightening procedure from step (1).



INSPECTION

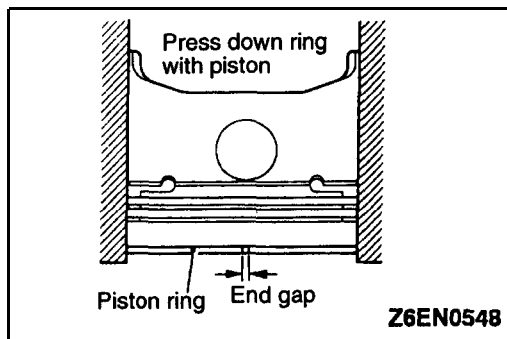
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PISTON RING

- (1) Check the piston ring for **damage, excessive wear, and breakage** and replace if defects **are evident**. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.
- (2) Check for the clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

Standard value: 0.03–0.07 mm (.0012–.0028 in.)

Limit: 0.1 mm (.004 in.)



- (3) Install the piston ring into the cylinder bore. Force it down with a piston, its crown being in contact with the ring, to correctly position it at right angles to the cylinder wall. Then, measure the end gap with a feeler gauge. If the ring gap is excessive, replace the piston ring.

Standard value:

No.1 ring 0.25–0.35 mm (.0098–.0138 in.)

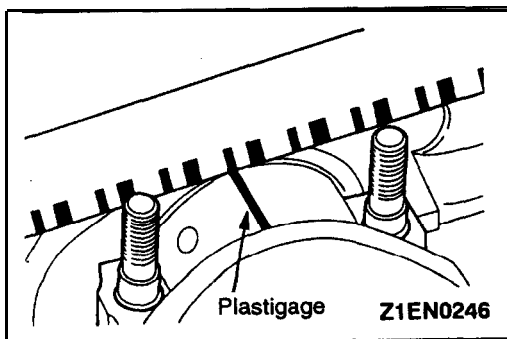
No.2 ring 0.40–0.55 mm (.0157–.0217 in.)

Oil ring 0.10–0.40 mm (.0039–.0157 in.)

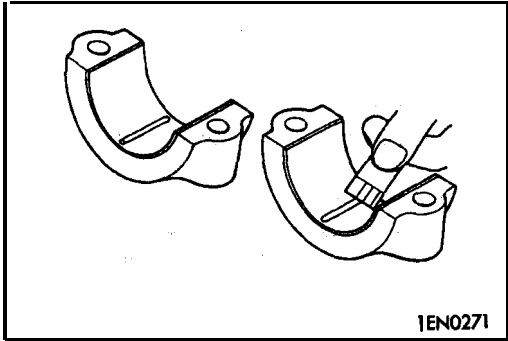
Limit:

No. 1, No. 2 ring 0.8 mm (.031 in.)

Oil ring 1.0 mm (.039 in.)

CRANKSHAFT PIN OIL CLEARANCE
(PLASTIGAGE METHOD)

- (1) Remove oil from crankshaft pin and connecting rod bearing.
- (2) Cut the Plastigage to the same length as the width of bearing and place it on crankshaft pin in parallel with its axis.




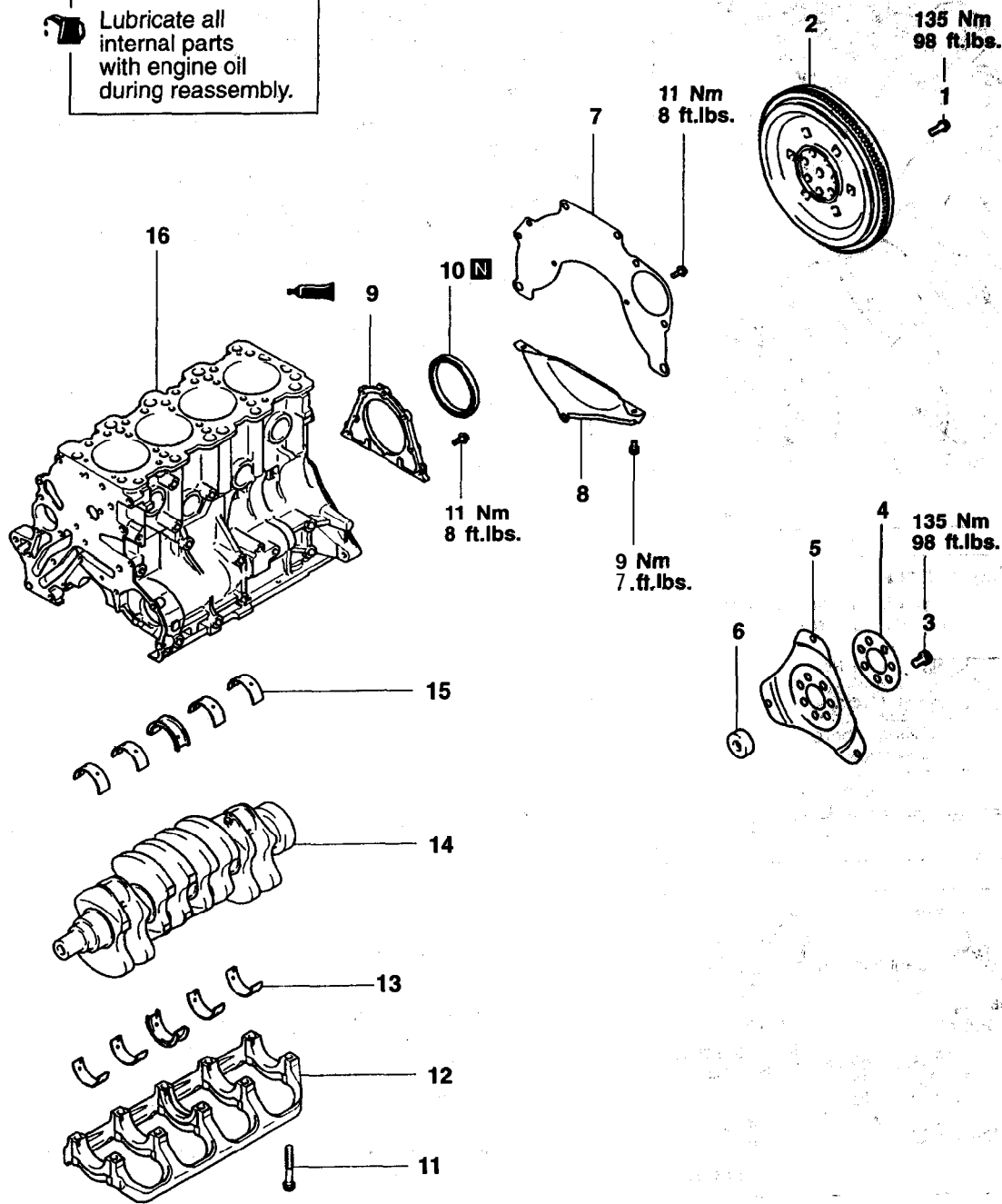
- (3) Install the connecting rod cap carefully and tighten' the nuts to specified torque.
- (4) Carefully remove the **connecting rod cap**.
- (5) Measure the width of the **Plastigage** at its widest part by using a scale printed on the **Plastigage** package.

Standard value: 0.02–0.05 mm (.0008–.0020 in.)
Limit: 0.1 mm (.004 in.)

CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION









 Lubricate all internal parts with engine oil during reassembly.

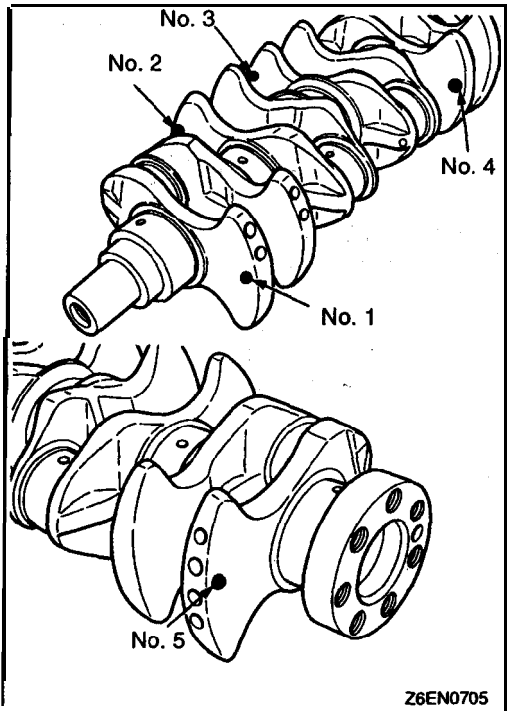


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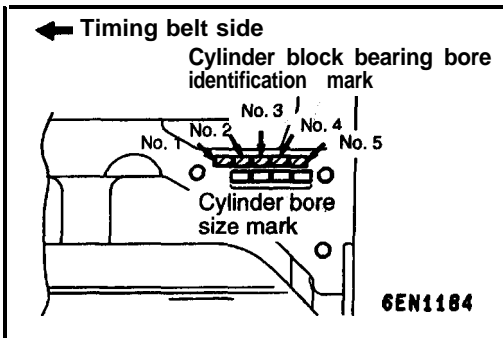
Removal steps

1. Flywheel bolt <M/T>
2. Flywheel <M/T>
3. Drive plate bolt <A/T>
4. Adapter plate <A/T>
5. Drive plate <A/T>
6. Crankshaft bushing <A/T>
7. Rear plate
8. Bell housing cover

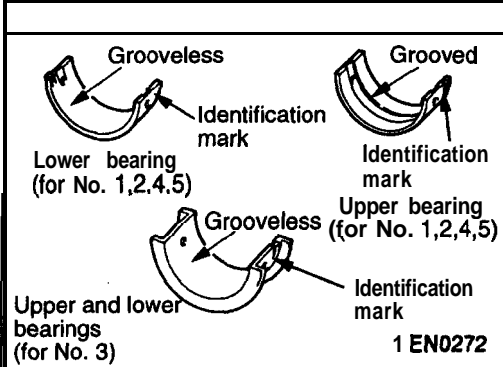
-  **D** 9. Oil seal case
-  **C** 10. Oil seal
-  **B** 11. Bearing cap bolt
-  **B** 12. Bearing cap
-  **A** 13. Crankshaft bearing (lower)
-  **A** 14. Crankshaft
-  **A** 15. Crankshaft bearing (upper)
-  **A** 16. Cylinder block



Z6EN0705



6EN1184



1 EN0272

REASSEMBLY SERVICE POINTS

▶◀ CRANKSHAFT BEARING INSTALLATION

When the bearing needs replacing, select and install a proper bearing by the following procedure.

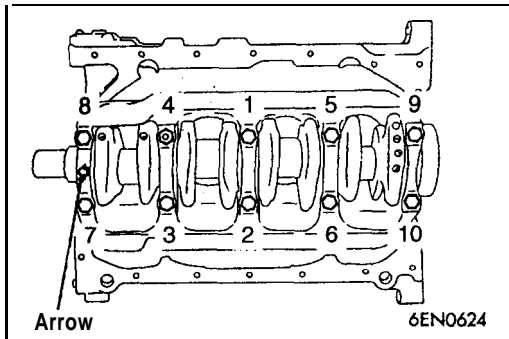
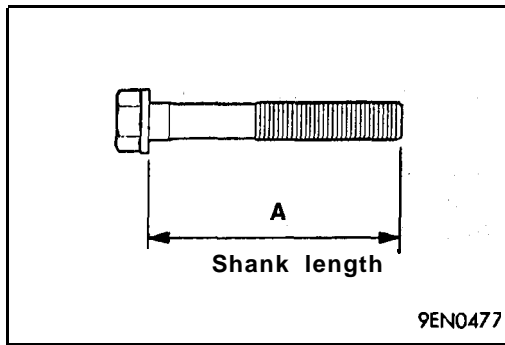
- (1) Measure the crankshaft journal diameter and confirm its classification from the following **table**. In the case of a crankshaft supplied as a **service part**, identification colors of its journals are painted at the positions shown in the illustration.
- (2) The cylinder block bearing bore diameter identification marks are stamped at the position shown in the illustration from the front of engine, beginning at No. 1.

Crankshaft journal				Cylinder block bearing bore	Crankshaft bearing
Classification	Identification mark (for production part)	Identification color (for service part)	Outer diameter mm (in.)	Identification mark	Identification mark (for service part)
1	None	Yellow	56.994–57.000 (2.2439–2.2441)	0	1
				1	2
				2	3
2	None	None	56.988–56.994 (2.2436–2.2439)	0	2
				1	3
				2	4
3	None	White	56.982–56.988 (2.2438–2.2436)	0	3
				1	4
				2	5

- (3) Select a proper bearing from **the** above table on the basis of the identification data confirmed under Items (1) and (2).

[Example]

1. If the measured value of a 'crankshaft journal outer diameter is between 56.994 – 57.000 mm (2.2439 – 2.2441 in.), the journal is classified as "1" in the **table**. In case the **crankshaft** is also replaced by a spare part, check the identification colors of the journals painted on the new **crankshaft**. If the color is yellow, for example, the **journal** is classified as "1".
2. Next, check the cylinder' block bearing hole identification mark stamped **on** the cylinder block. If it is "0", read the "**Bearing** identification mark" column to find the identification mark of the bearing to be used. In this case, it is "1".
- (4) Install the bearings having an oil groove to the cylinder block.
- (5) Install the bearings having no oil **groove** to the bearing cap.



►B◄ **BEARING CAP / BEARING CAP BOLT INSTALLATION**

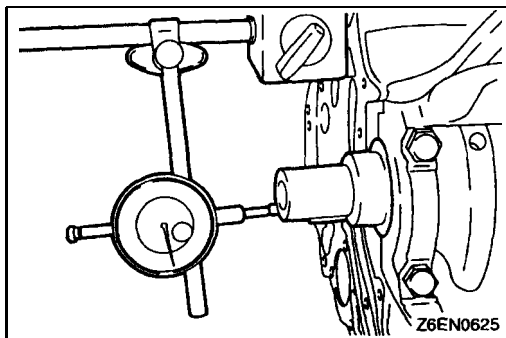
- (1) Install the bearing caps so that **the arrow** points to the timing belt side.
- (2) Before installing the bearing cap bolts, check that the shank length of each bolt “meets the limit.” If the limit is exceeded, replace the bolt.

Limit (A): Max. 71.1 mm (2.80 in.)

- (3) Apply engine oil to the threaded portion **and bearing** surface of the bolt.
- (4) Tighten the bolts to 25 Nm (**18 ft.lbs.**) in ‘the’ **specified** tightening sequence.
- (5) Make a paint mark on the head of each bolt.
- (6) Make a paint mark on the bearing cap at the position **90° to 100°** from the paint mark made on the bolt in the direction of tightening the bolt.
- (7) According to the specified tightening sequence, give a **90° to 100°** turn to each bolt and make sure that the paint mark on the bolt and that on the cap are in alignment.

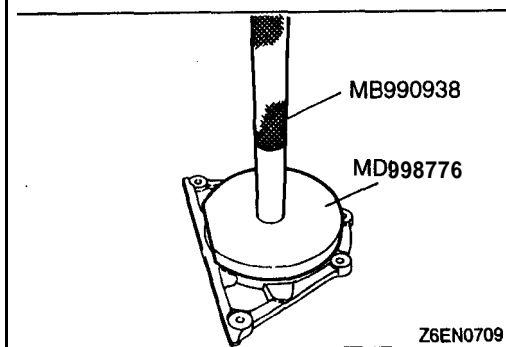
Caution

1. If the bolt is turned less than **90°**, proper fastening performance may not be expected. When **tightening the bolt**, therefore, be careful to **give a sufficient turn** to it.
2. If the bolt is **overtightened (exceeding 100°)**, loosen the bolt completely and then retighten it by repeating the tightening procedure from step (1).



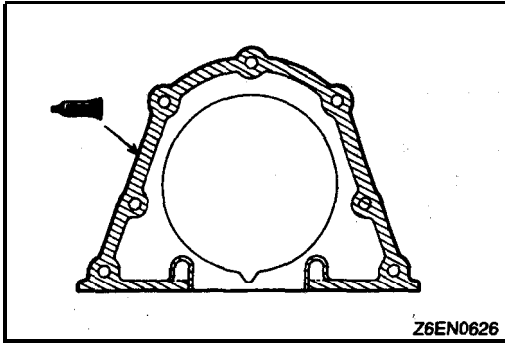
- (8) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace **No.3** crankshaft bearings.

Standard value: 0.05–0.18 mm (.0020–.0071 in.)
Limit: 0.25 mm (.0098 in.)



►C◄ **OIL SEAL INSTALLATION**

11F-60 ENGINE OVERHAUL <2.4L> – Crankshaft. Flywheel and Drive Plate



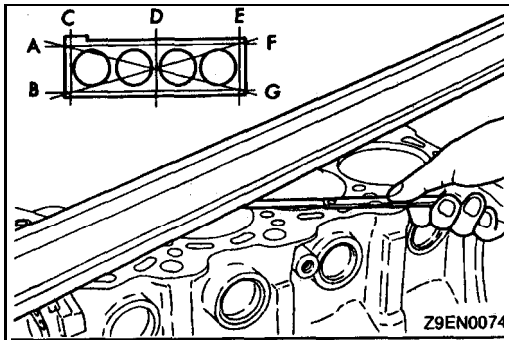
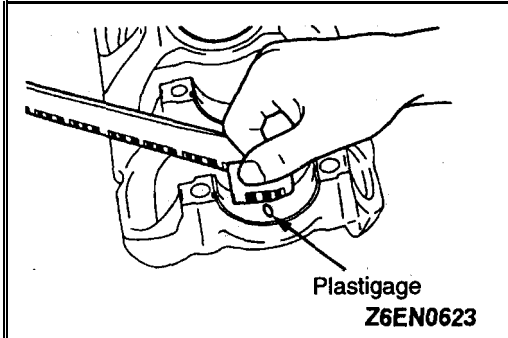
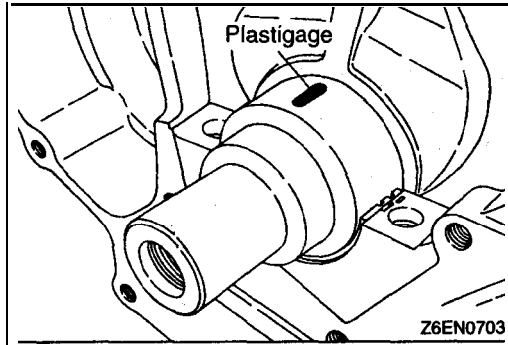
▶D◀ SEALANT APPLICATION TO OIL SEAL CASE

Specified sealant:

Mitsubishi Genuine Part No. **MD970389** or equivalent

NOTE

- (1) Be sure to install the case quickly while the sealant is wet (within 15 minutes).
- (2) After installation, keep the sealed area **away** from the oil and coolant for approx. one hour.



INSPECTION

CRANKSHAFT OIL CLEARANCE (PLASTIGAGE METHOD)

- (1) Remove oil from the crankshaft **journal and crankshaft bearing.**
- (2) Install the crankshaft.
- (3) Cut the **Plastigage** to the same length as the **width** of bearing and place it on **journal in parallel** with its axis;
- (4) Install the crankshaft bearing cap carefully and tighten the bolts to the specified torque.
- (5) Carefully remove the crankshaft bearing cap.
- (6) Measure the width of the Plastigage at its widest part by using a scale printed on the Plastigage package.

Standard value: 0.02–0.04 mm (.0008–.0016 in.)
Limit: 0.1 mm (.004 in.)

CYLINDER BLOCK

- (1) Visually check for scratches, rust, and corrosion. Use also a flaw detecting agent for the check. If defects are evident, correct, or replace.
- (2) Using a straightedge and feeler gauge, check the block top **surface for warpage.** Make sure that the surface is free from gasket chips and other foreign matter.

Standard value: 0.05 mm (.0020 in.)
Limit: 0.1 mm (.004 in.)

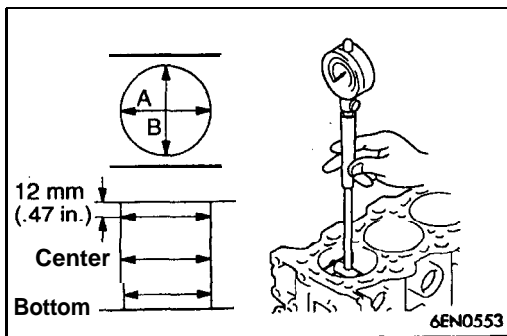
- (3) If the distortion is excessive, correct within the allowable limit or replace.

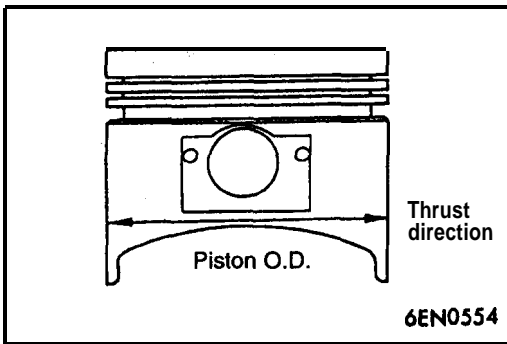
Grinding limit: 0.2 mm (.008 in.)
Includes/combined with cylinder head grinding
Cylinder block height (when new):
289.9–290.1 mm (11.413-11.421 in.)

- (4) Check cylinder walls for scratches and seizure. If defects are evident, correct (bored to oversize) or replace.

- (5) Using cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct cylinder to an oversize and replace piston and piston rings. Measure at the points shown in illustration.

Standard value:
Cylinder I.D. 86.50 mm (3.4055 in.)
Cylindricity 0.01 mm (.0004 in.) or less





BORING CYLINDER

- (1) Oversize pistons to be used should **be** determined on the basis of the largest bore **cylinder**.

Piston size identification

Size	Identification mark
0.50 O.S.	0.50
1.00 O.S.	1.00

NOTE

Size mark is stamped on piston top.

- (2) **Measure** outside diameter of piston to be used. **Measure** it in thrust direction as shown.
- (3) Based on measured piston O.D. calculate boring **finish dimension**.

Boring finish dimension = Piston O.D. + (clearance between piston O.D. and cylinder) – 0.02 mm (.0008 in.) (honing margin)

- (4) Bore all cylinders to calculated boring finish dimension.

Caution

To prevent distortion that may result from temperature rise during honing, bore cylinders, working from No. 2 to No. 4 to No. 1 to No. 3.

- (5) Hone to final finish dimension (piston O.D. + clearance between piston O.D. and cylinder).
- (6) Check clearance between- piston and cylinder.

**Clearance between piston and cylinder:
0.02–0.04 mm (.0008–.0016 in.)**

NOTE

When boring cylinders, finish all of four cylinders to same **oversize**. **Do** not bore only one cylinder to an **oversize**.