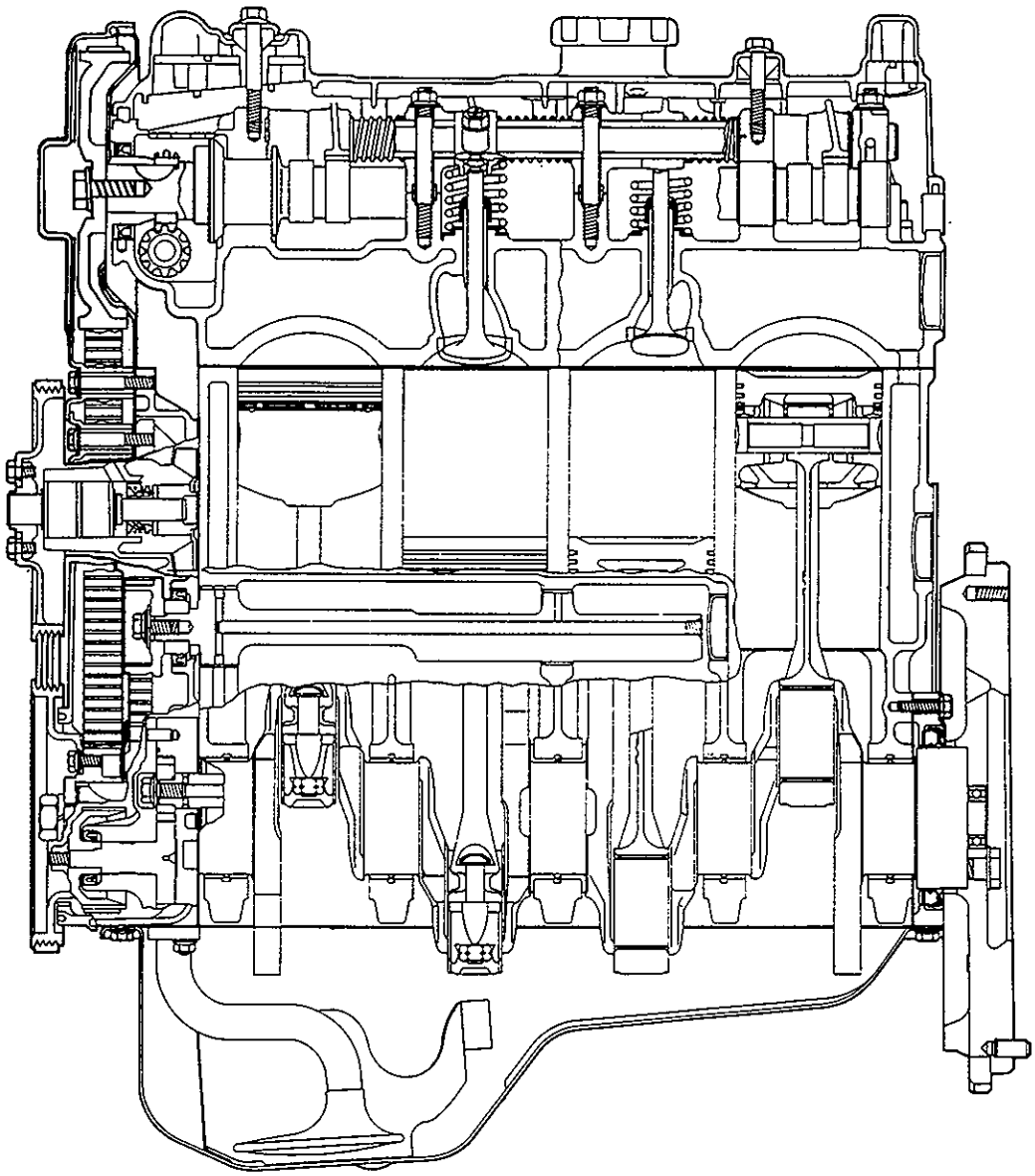
ENGINE

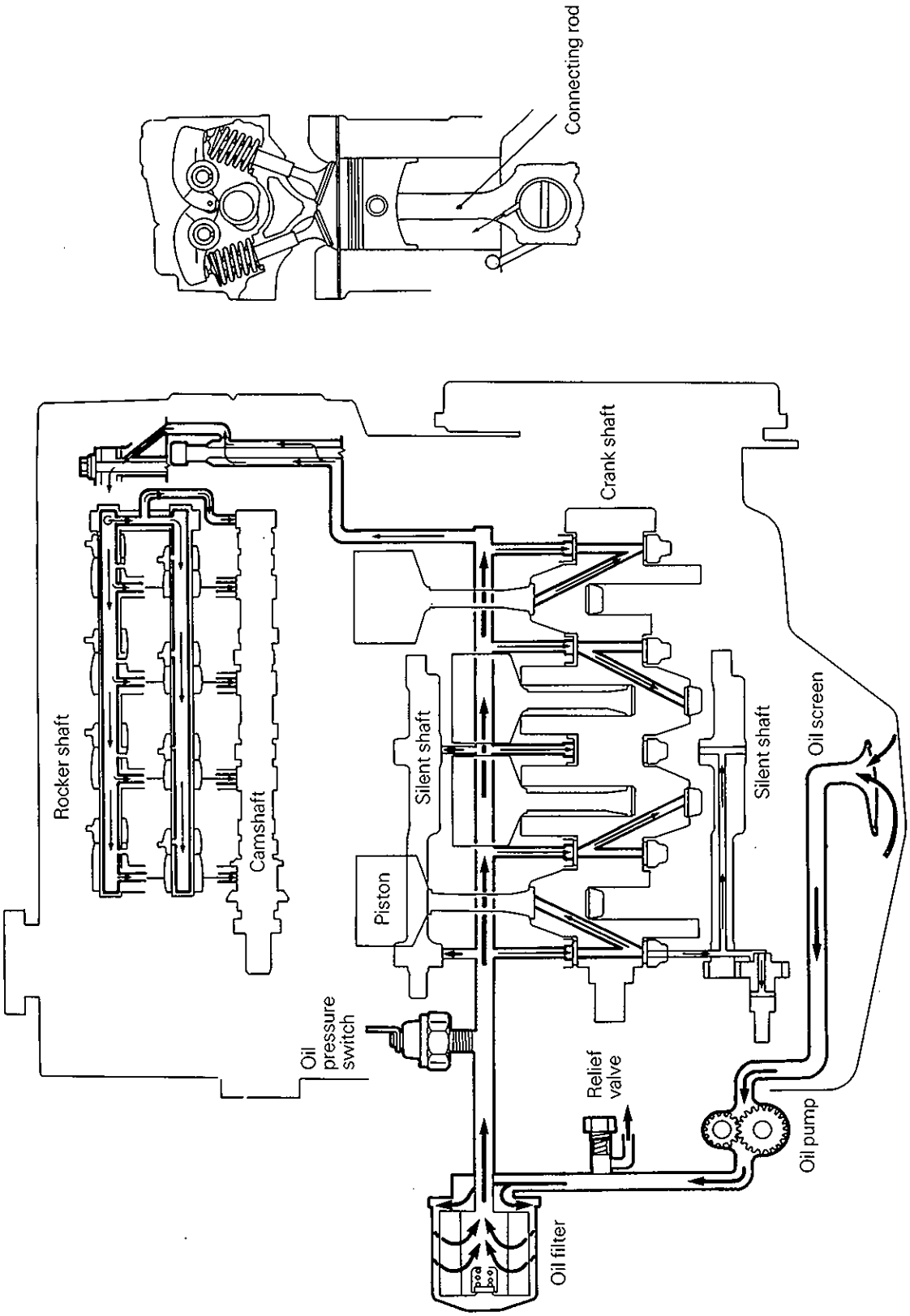
4G3 SERIES

CONTENTS



3EN0003

LUBRICATION SYSTEM – ENGINES WITH SILENT SHAFTS



3LU0011

1. SPECIFICATIONS

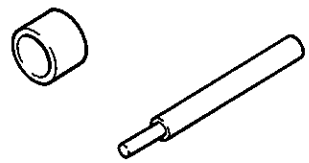
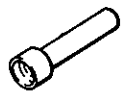
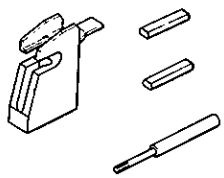
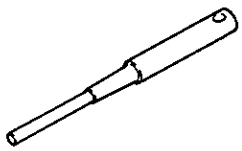
GENERAL SPECIFICATIONS

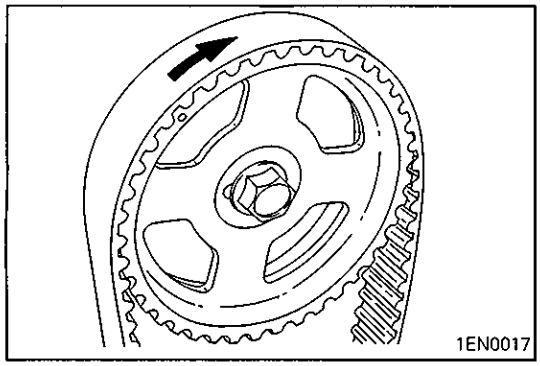
Description	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Compact type
Total displacement	
4G33	1,439 cc (87.81 cu.in.)
4G32	1,597 cc (97.45 cu.in.)
4G37	1,755 cc (107.10 cu.in.)
Cylinder bore	
4G33	73 mm (2.87 in.)
4G32	76.9 mm (3.03 in.)
4G37	80.6 mm (3.17 in.)
Piston stroke	86 mm (3.39 in.)
Compression ratio	
4G33	9.0
4G32	8.5
4G37	9.5
Valve timing: Camshaft identification mark "1"	
Intake valve	
Opens	20°
Closes	48°
Exhaust valve	
Opens	51°
Closes	17°
Valve timing: Camshaft identification mark "6"	
Intake valve	
Opens	24°
Closes	64°
Exhaust valve	
Opens	67°
Closes	21°
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	
Engines with silent shafts	Involute gear type
Engines without silent shafts	Trochoid type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type

mm (in.)

	Standard	Limit
Silent shaft		
Journal diameter		
Right (front)	38.96 – 38.98 (1.5339 – 1.5346)	
(rear)	35.95 – 35.97 (1.4154 – 1.4161)	
Left (front)	18.47 – 18.48 (0.7272 – 0.7276)	
(rear)	35.95 – 35.97 (1.4154 – 1.4161)	
Oil clearance		
Right (front)	0.02 – 0.06 (0.0008 – 0.0024)	
(rear)	0.05 – 0.09 (0.0020 – 0.0035)	
Left (front)	0.02 – 0.05 (0.0008 – 0.0020)	
(rear)	0.05 – 0.09 (0.0020 – 0.0035)	
Piston		
O.D.	4G33: 72.97 – 73.00 (2.8728 – 2.8740)	
	4G32: 76.86 – 76.89 (3.0260 – 3.0272)	
	4G37: 80.57 – 80.60 (3.1720 – 3.1732)	
Piston-to-cylinder clearance	0.01 – 0.03 (0.0004 – 0.0012)	
Ring groove width		
No. 1 ring	1.52 – 1.54 (0.0598 – 0.0606)	
No. 2 ring	1.51 – 1.53 (0.0594 – 0.0602)	
Oil ring	4.02 – 4.05 (0.1583 – 0.1594)	
Service size	0.50 (0.02), 1.00 (0.04) oversize	
Piston ring		
End gap		
No. 1 ring	4G33: 0.25 – 0.45 (0.0098 – 0.0177)	0.8 (0.031)
	4G32: 0.25 – 0.40 (0.0098 – 0.0157)	0.8 (0.031)
	4G37: 0.30 – 0.45 (0.0118 – 0.0177)	0.8 (0.031)
No. 2 ring	4G33: 0.25 – 0.45 (0.0098 – 0.0177)	0.8 (0.031)
	4G32: 0.20 – 0.35 (0.0079 – 0.0138)	0.8 (0.031)
	4G37: 0.20 – 0.55 (0.0079 – 0.0217)	0.8 (0.031)
Oil ring	0.20 – 0.70 (0.0079 – 0.0276)	1.0 (0.039)
Ring-to-ring groove clearance		
No. 1 ring	0.03 – 0.09 (0.0012 – 0.0035)	
No. 2 ring	0.02 – 0.06 (0.0008 – 0.0024)	
Service size	0.50 (0.02), 1.00 (0.04) oversize	
Piston pin		
O.D.	19.00 – 19.01 (0.7480 – 0.7484)	
Press-in load N (kg, lbs.)	5,000 – 15,000 (500 – 1,500, 1,102 – 3,307)	
Press-in temperature	Room temperature	
Connecting rod		
Big end center-to small end center length	153.6 – 153.7 (6.047 – 6.051)	
Bend	0.05 (0.0020)	
Twist	0.1 (0.004)	
Big end side clearance	0.10 – 0.25 (0.0039 – 0.0098)	0.4 (0.016)

2. SPECIAL TOOLS

Tool	Number	Name	Use
	MD998002	Valve guide installer	Removal and installation of valve guide
	MD998005	Valve stem seal installer	Installation of valve stem seal
	MD998011	Crankshaft rear oil seal installer	Installation of crankshaft rear oil seal
	MD998128	Piston pin setting tool	Removal and installation of piston pin
	MD998148	Valve seat cutter pilot	Correction of valve seat
	MD998158 (intake) MD998157 (exhaust)	Valve seat cutter 45°	Correction of valve seat
	MD998165	Valve seat cutter 65°	Correction of valve seat

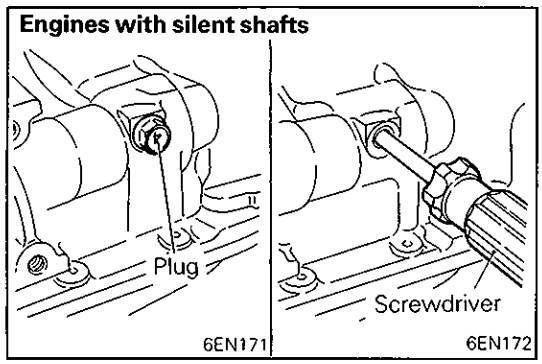


SERVICE POINTS OF REMOVAL

◇A◇ REMOVAL OF TIMING BELT

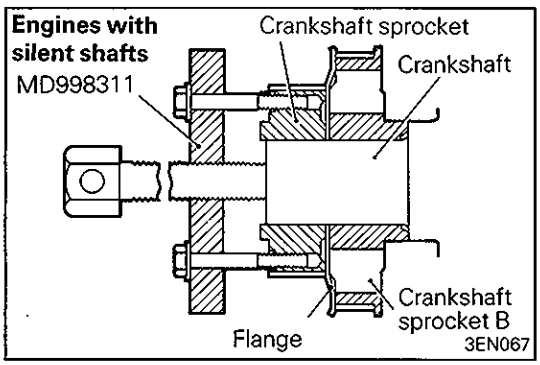
(1) Make a mark on the back of the timing belt indicating the direction of rotation so it may be reassembled in the same direction if it is to be reused.

NOTE
(1) Water or oil on the belt 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.

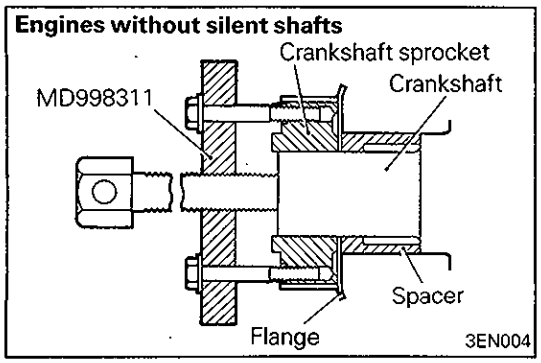


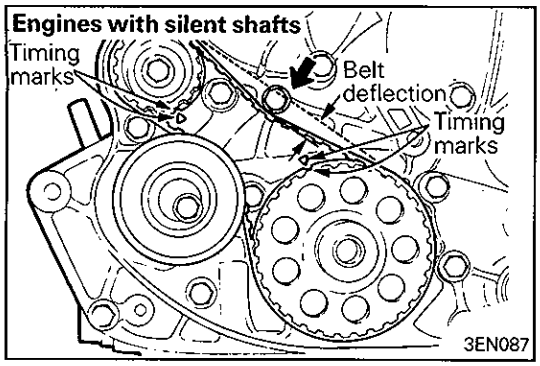
◇B◇ REMOVAL OF OIL PUMP SPROCKET (ENGINES WITH SILENT SHAFTS)

(1) Remove the plug on the left side of cylinder block.
(2) Insert a Phillips screwdriver [shank diameter 8 mm (0.31 in.)] to block the left silent shaft.
(3) Remove the nuts.
(4) Remove the oil pump sprocket.

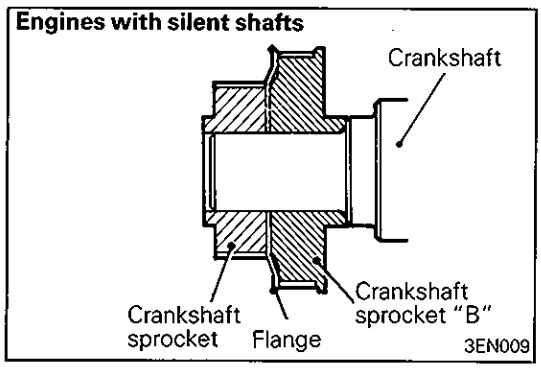


◇C◇ REMOVAL OF CRANKSHAFT SPROCKET



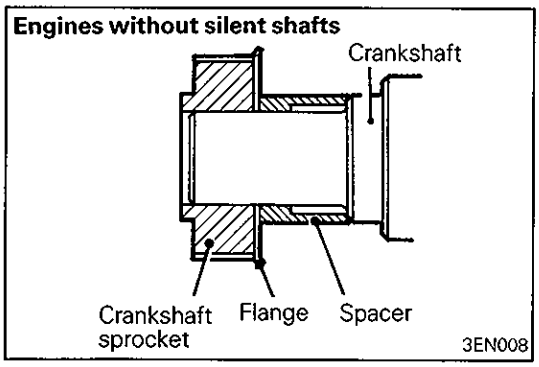


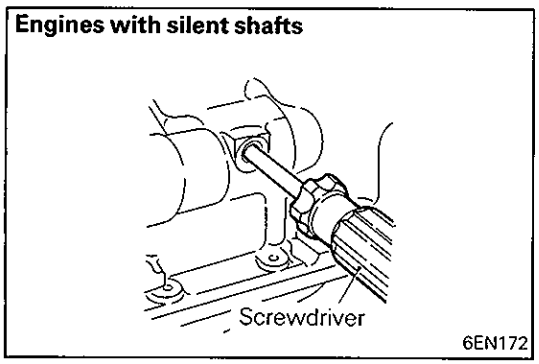
(5) Check to ensure that timing marks on sprockets and front case are in alignment.
(6) Press with index finger the center of span on tension side of timing belt "B". The bolt must deflect 5 to 7 mm (0.20 to 0.28 in.).



◆C◆ INSTALLATION OF FLANGE

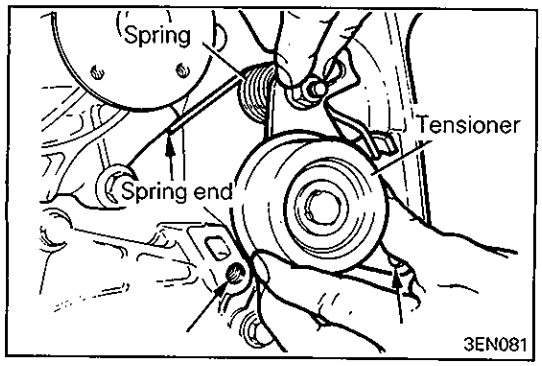
(1) Pay special attention to direction of flange. If it is installed in wrong direction, a broken timing belt could result.





◆D◆ INSTALLATION OF OIL PUMP SPROCKET (ENGINES WITH SILENT SHAFTS)

(1) Insert a Phillips screwdriver [shank diameter 8 mm (0.31 in.) shaft] through the plug hole on the left side of cylinder block to block the left silent shaft.
(2) Install the oil pump sprocket.
(3) Tighten the nuts to the specified torque.

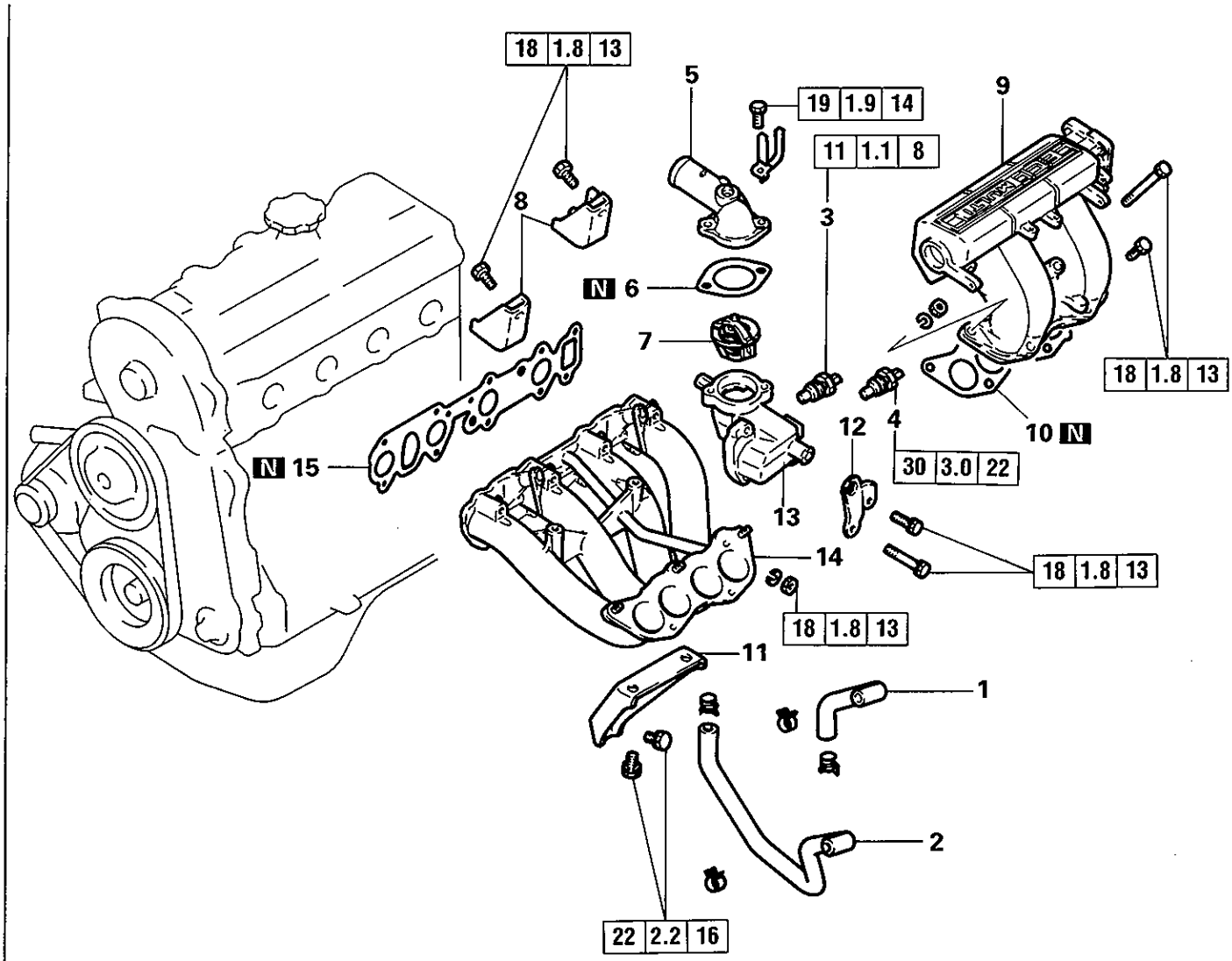


◆E◆ INSTALLATION OF TENSIONER

(1) Hook the tensioner spring ends to the water pump body projection and tensioner bracket.

REMOVAL AND INSTALLATION

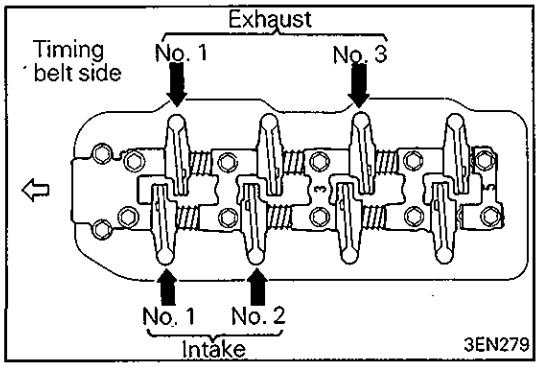
<FRONT WHEEL DRIVE VEHICLES – MULTI POINT FUEL INJECTION TYPE>



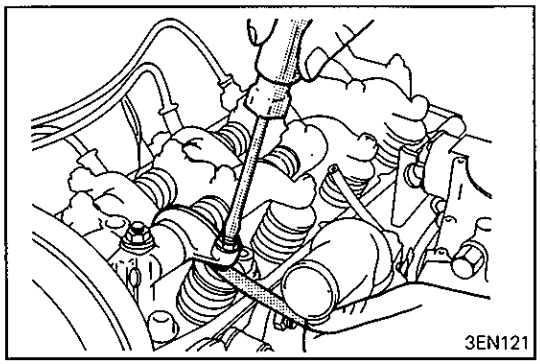
Removal steps

1. Water hose "A"
2. Water hose "B"
- ◆C◆ 3. Water temperature gauge unit
- ◆B◆ 4. Water temperature sensor
5. Water outlet fitting
- ◆A◆ 6. Water outlet fitting gasket
7. Thermostat
8. Air intake plenum stay
9. Air intake plenum
10. Air intake plenum gasket
11. Intake manifold stay
12. Engine hanger
13. Thermostat housing
14. Intake manifold
15. Intake manifold gasket

3EN0131



(2) Adjust the valve clearance at points shown in the illustration.

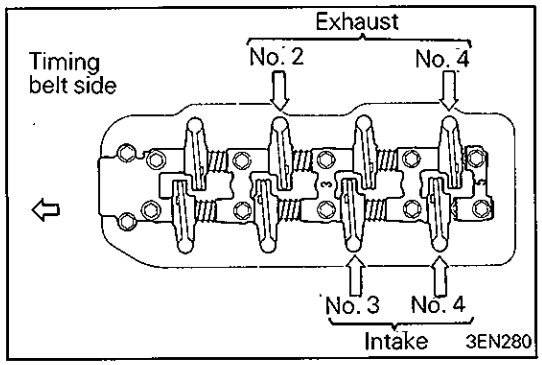


(3) Loosen the adjusting screw lock nut.
(4) Using a thickness gauge, adjust the valve clearance by turning the adjusting screw.

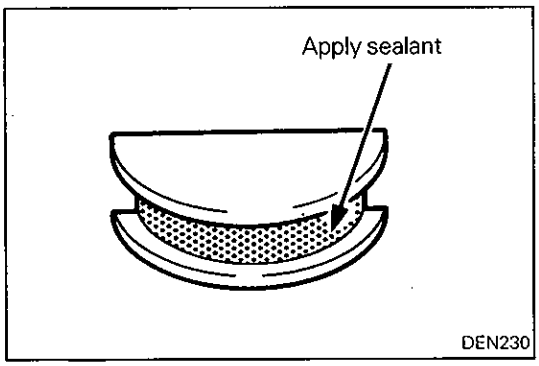
Standard value: on cold engine

0.07 mm (0.0028 in.)	**Intake**
0.17 mm (0.0067 in.)	**Exhaust**

(5) While holding the adjusting screw with a screwdriver, tighten the lock nut.



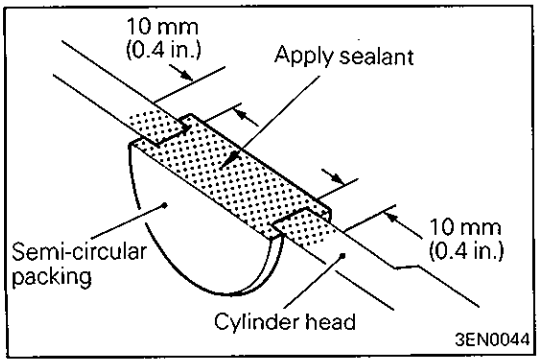
(6) Rotate clockwise the crankshaft one complete turn (360°).
(7) Adjust the valve clearance at points shown in the illustration.
(8) Repeat steps (3) to (5) to adjust the valve clearance of remaining valves.

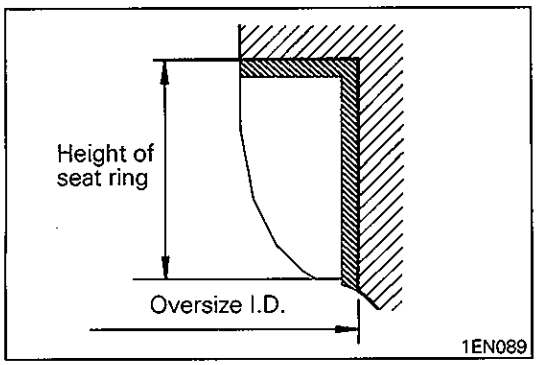


◆C◆ INSTALLATION OF SEMI-CIRCULAR PACKING

(1) Apply specified sealant to portions indicated in illustration.

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

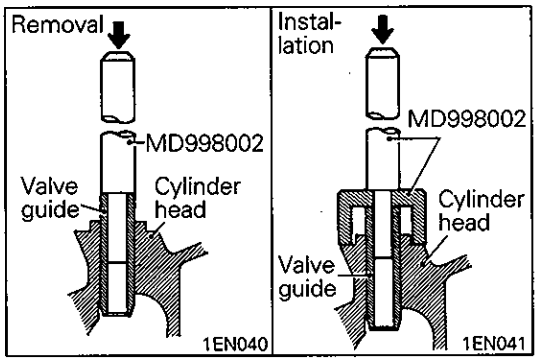




(2) Rebore the valve seat hole in cylinder head to a selected oversize valve seat diameter.

Intake valve seat hole diameter:
4G33, 4G32
0.30 O.S. ... 39.30 – 39.33 mm (1.5472 – 1.5484 in.)
0.60 O.S. ... 39.60 – 39.63 mm (1.5591 – 1.5602 in.)
4G37
0.30 O.S. ... 43.30 – 43.33 mm (1.7047 – 1.7059 in.)
0.60 O.S. ... 43.60 – 43.63 mm (1.7165 – 1.7177 in.)
Exhaust valve seat hole diameter:
4G33, 4G32
0.30 O.S. ... 34.30 – 34.33 mm (1.3504 – 1.3516 in.)
0.60 O.S. ... 34.60 – 34.63 mm (1.3622 – 1.3634 in.)
4G37
0.30 O.S. ... 37.30 – 37.33 mm (1.4685 – 1.4697 in.)
0.60 O.S. ... 37.60 – 37.63 mm (1.4803 – 1.4815 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 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 special tool 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.

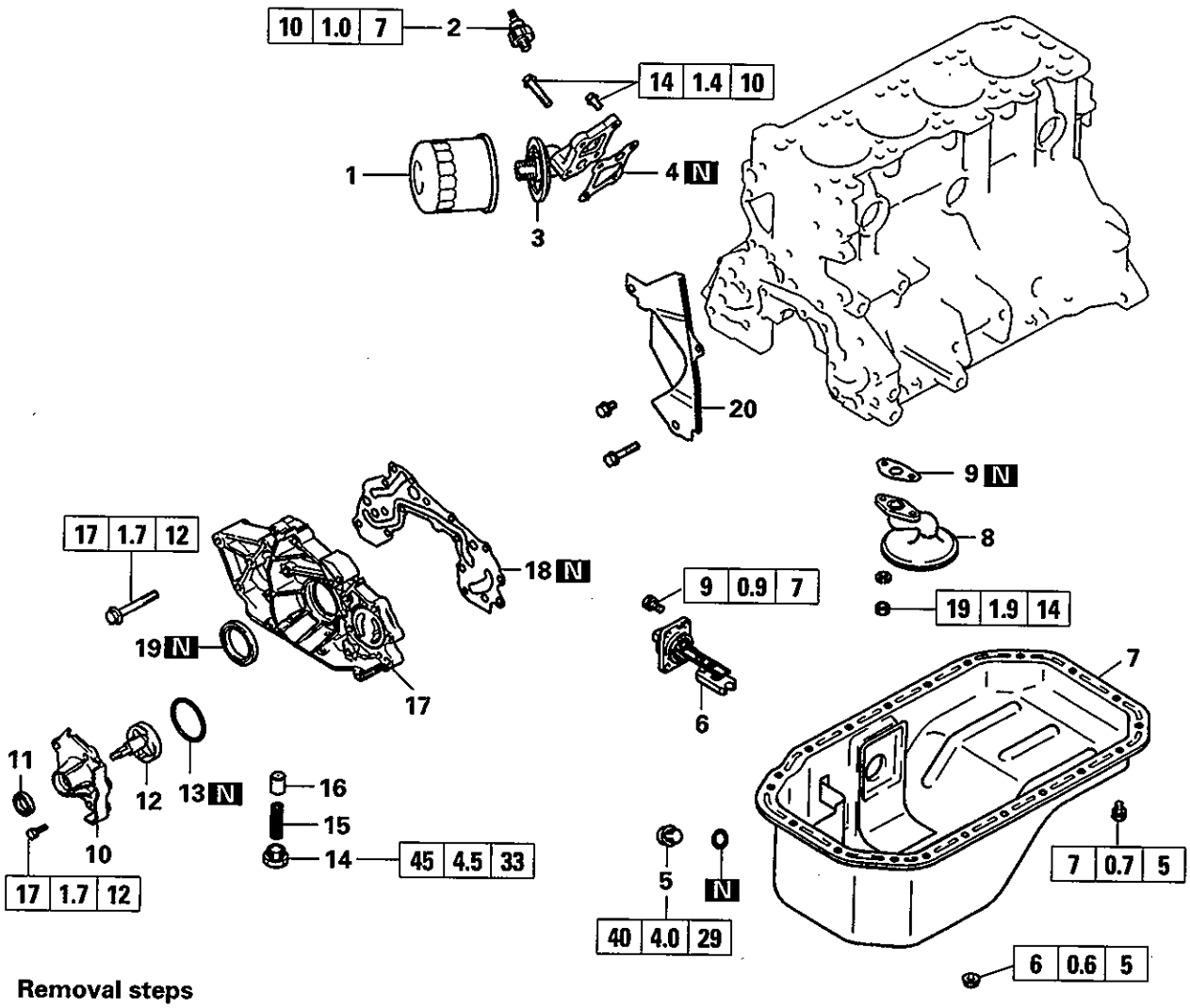
Valve guide hole diameter:
0.05 O.S. ... 13.05 – 13.07 mm (0.5138 – 0.5146 in.)
0.25 O.S. ... 13.25 – 13.27 mm (0.5217 – 0.5224 in.)
0.50 O.S. ... 13.50 – 13.52 mm (0.5315 – 0.5323 in.)

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.

REMOVAL AND INSTALLATION

<ENGINE WITHOUT SILENT SHAFTS>



Removal steps

- ◆M◆ 1. Oil filter
- ◆L◆ 2. Oil pressure switch
- 3. Oil filter bracket
- 4. Gasket
- 5. Drain plug
- 6. Oil level sensor
- ◇A◇ ◆K◆ 7. Oil pan
- 8. Oil screen
- 9. Oil screen gasket
- 10. Oil pump cover
- ◆J◆ 11. Oil pump oil seal
- ◆I◆ 12. Oil pump rotor assembly
- ◆H◆ 13. Oil pump cover gasket
- 14. Plug
- 15. Relief spring
- 16. Relief plunger
- ◇C◇ ◆E◆ 17. Front case
- 18. Front case gasket
- ◆C◆ 19. Crankshaft oil seal
- 20. Timing belt under lower cover

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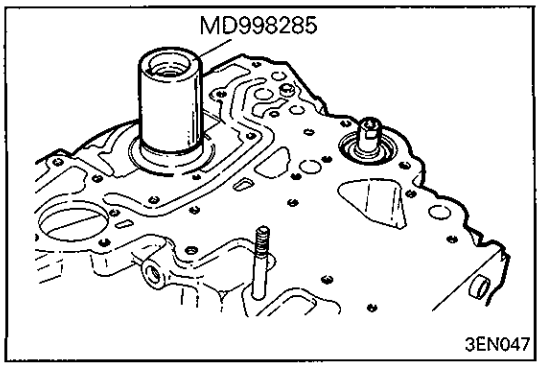
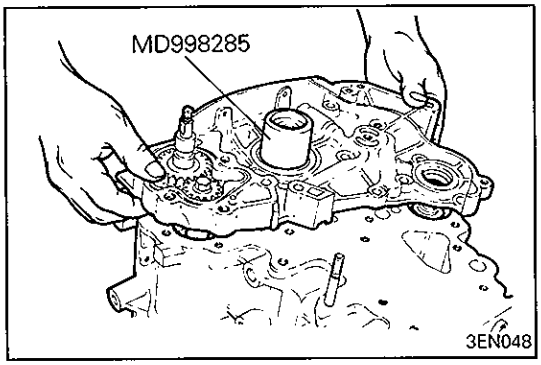
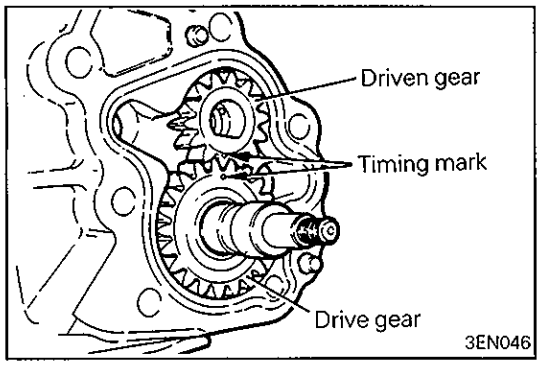


◆E◆ INSTALLATION OF FRONT CASE

(1) Set the special tool on the front end of crankshaft and apply engine oil to the outer circumference of the special tool.

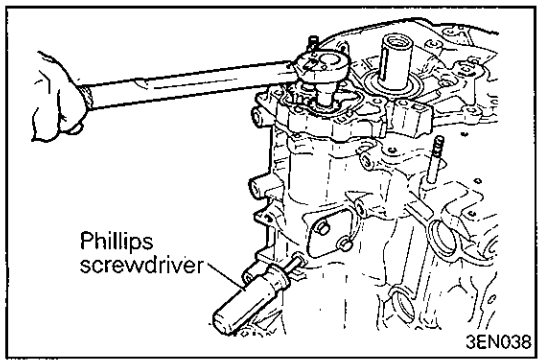


(2) Install the front case.



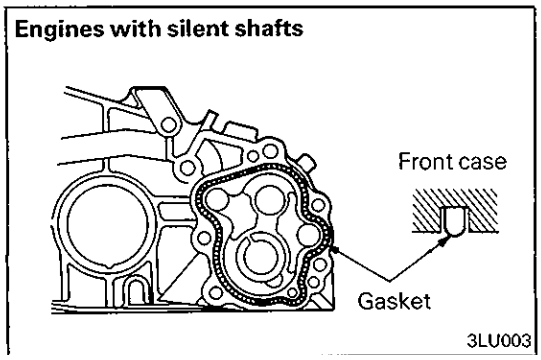
◆F◆ INSTALLATION OF OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR

(1) Install the oil pump drive gear and driven gear to the front case, lining up the timing marks. Apply lubricate the gears with engine oil.



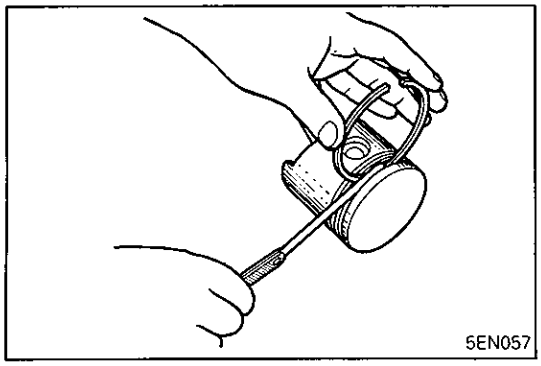
◆G◆ INSTALLATION OF FLANGE BOLT

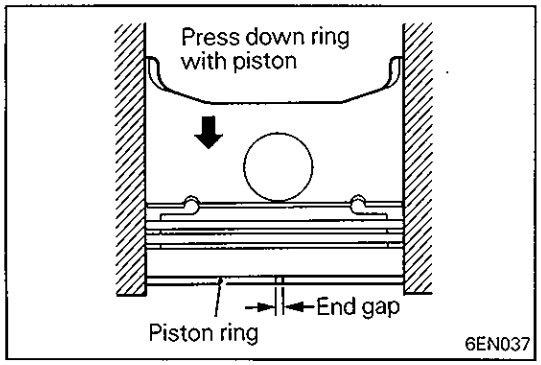
(1) Insert a Phillips screwdriver [shank diameter 8 mm (0.32 in.)] into the plug hole on the left side of cylinder block to block the silent shaft, then tighten the flange bolt.



◆H◆ INSTALLATION OF OIL PUMP COVER GASKET

(1) Install a new oil pump cover gasket in the groove of the front case.
When installing the gasket, face the round side to the oil pump cover.





PISTON RING

(1) Check for side clearance.
If the limit is exceeded, replace the ring or piston, or both.

Standard value:
0.03 – 0.09 mm (0.0012 – 0.0035 in.) ..... No. 1
0.02 – 0.06 mm (0.0008 – 0.0024 in.) ..... No. 2

(2) Insert the piston ring into 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 thickness gauge. If the end gap is excessive, replace piston ring.

Standard value:
No. 1
0.25 – 0.45 mm (0.0098 – 0.0177 in.) 4G33
0.25 – 0.40 mm (0.0098 – 0.0157 in.) 4G32
0.30 – 0.45 mm (0.0118 – 0.0177 in.) 4G37
No. 2
0.25 – 0.45 mm (0.0098 – 0.0177 in.) 4G33
0.20 – 0.35 mm (0.0079 – 0.0138 in.) 4G32
0.20 – 0.55 mm (0.0079 – 0.0217 in.) 4G37
Oil 0.20 – 0.70 mm (0.0079 – 0.0276 in.)
Limit:
0.8 mm (0.031 in.) ..... No. 1, No. 2
1.0 mm (0.039 in.) ..... Oil

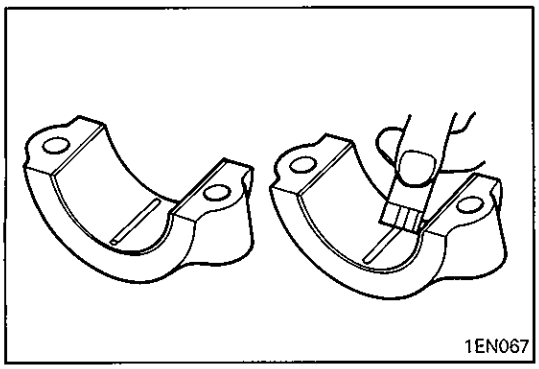
CONNECTING ROD BEARING

(1) Visually check the bearing surface for uneven contact, streaks, scratches, and seizure. Replace if defects are evident. If streaks and seizure are excessive, check also the crankshaft. If damage is present on the crankshaft, replace crankshaft or regrind to undersize for reuse.

Caution
- **Do not attempt an undersize machining on crankshaft with special surface treatment. This type of crankshaft can be identified by its dull gray appearance.**

(2) Measure the connecting rod bearing I.D. and crankshaft pin O.D. If the oil clearance exceeds the limit, replace bearing, and crankshaft if necessary.
Or, regrind the crankshaft to an undersize and replace bearing with an undersize one.

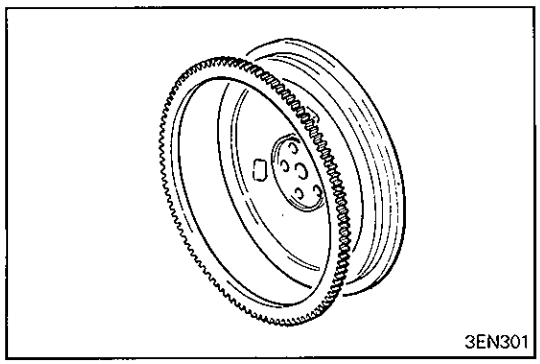
Standard value: 0.02 – 0.05 mm (0.0008 – 0.0020 in.)
Limit: 0.10 mm (0.0039 in.)



(4) Gently place the crankshaft bearing cap over it and tighten the bolts to the specified torque.
(5) Remove the bolts and gently remove the crankshaft bearing cap.
(6) Measure the width of the smashed plastic gauge at its widest section by using a scale printed on the plastic gauge bag.

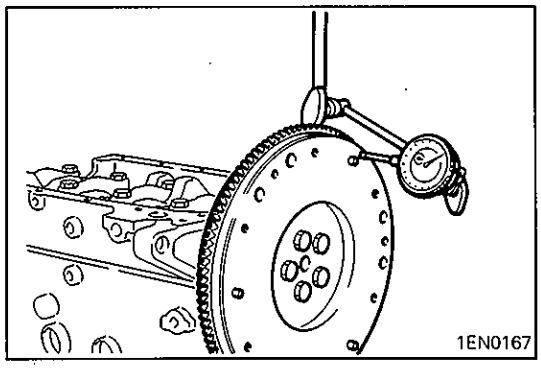
CRANKSHAFT REAR OIL SEAL

(1) Check oil seal lip for wear and damage.
(2) Check rubber for deterioration or hardening.
(3) Check oil seal case for cracks and damage.



RING GEAR

(1) Check teeth of ring gear for wear and damage. If necessary, replace the ring gear.
(2) If the ring gear teeth are worn or damaged, also check the starter motor pinion.
(3) To remove the ring gear, strike the ring gear at several points on its outer circumference. The ring gear cannot be removed if it is heated.
To install the ring gear, heat the ring gear to 260 – 280°C (500 – 536 °F) for shrink fit.



FLYWHEEL

(1) Check the clutch disc friction surface for ridge wear, streaks, and seizure. If necessary, replace flywheel.
(2) If the runout of flywheel exceeds the limit, replace.
Limit: 0.13 mm (0.0051 in.)

DRIVE PLATE

(1) Check the drive plate for deformation, damage and cracks. If necessary, replace.