
ENGINE

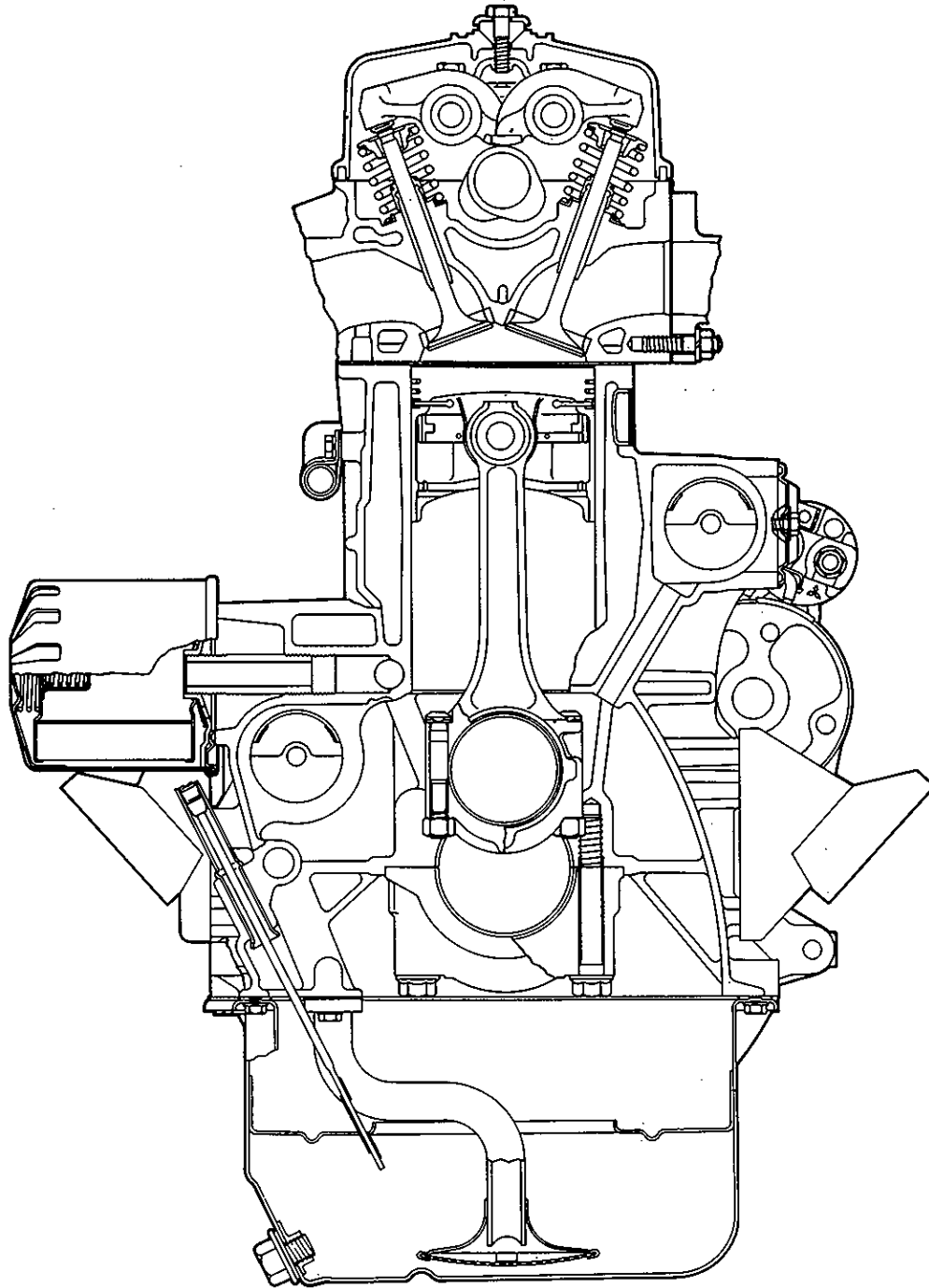
4G5 SERIES

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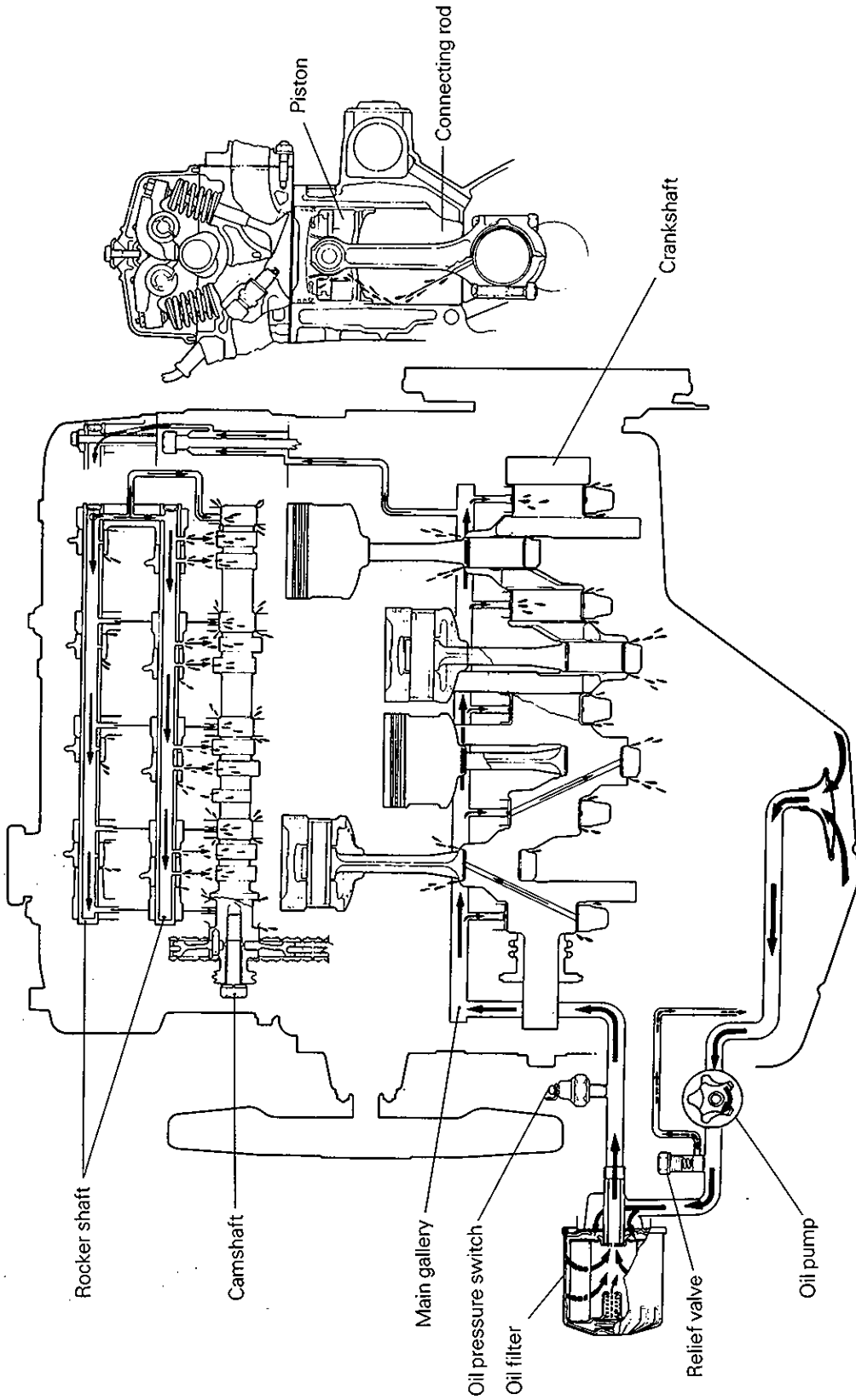
GENERAL INFORMATION

ENGINE SECTIONAL VIEW – ENGINE WITH SILENT SHAFT



1-9

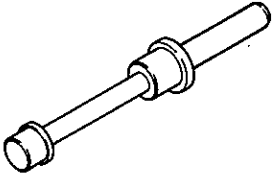
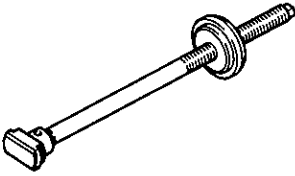
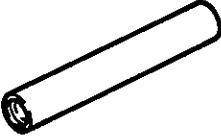
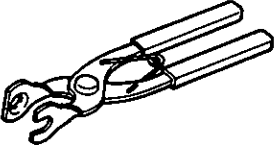
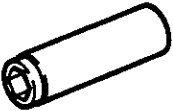
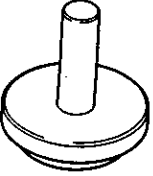
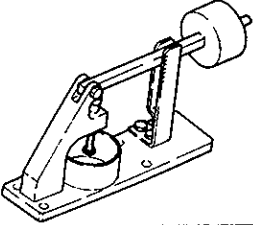
LUBRICATION SYSTEM – ENGINE WITHOUT SILENT SHAFT

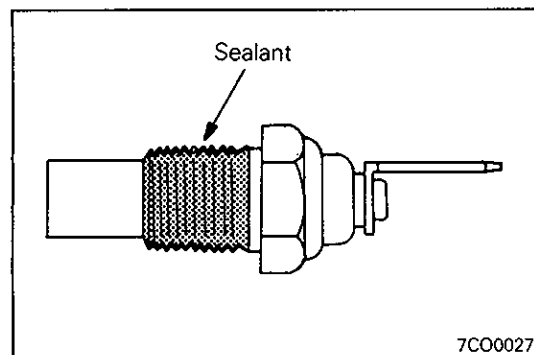
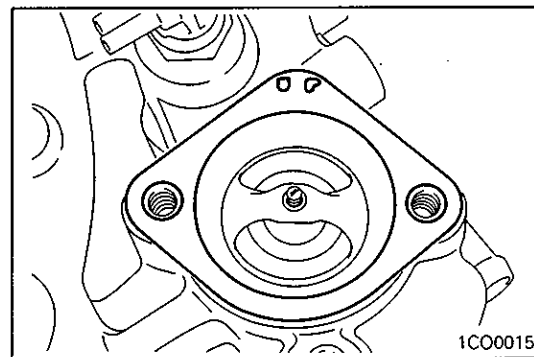
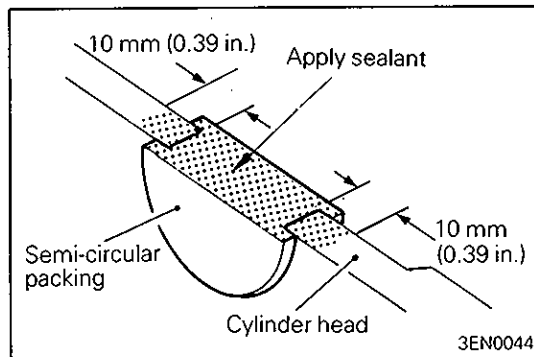
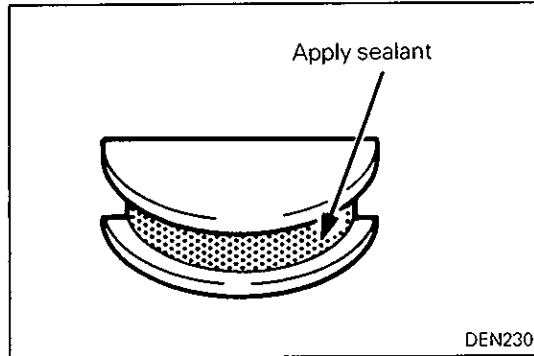
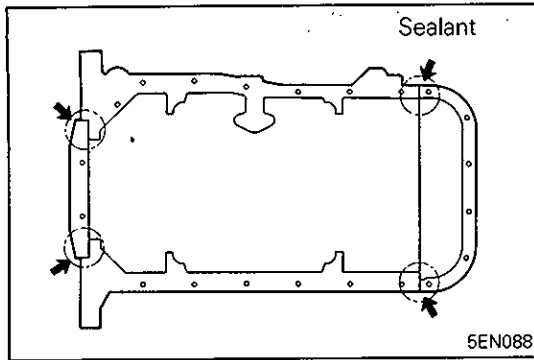


mm (in.)

	Standard	Limit
Valve		
Overall length		
Intake	108.0 (4.250)	
Exhaust	105.9 (4.168)	
Stem diameter		
Intake	7.96 – 7.98 (0.3134 – 0.3142)	
Exhaust	7.93 – 7.95 (0.3122 – 0.3130)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.2 (0.047)	0.7 (0.028)
Exhaust	2.0 (0.079)	1.5 (0.059)
Stem-to-guide clearance		
Intake	0.03 – 0.06 (0.0012 – 0.0024)	
Exhaust	0.05 – 0.09 (0.0020 – 0.0035)	
Valve spring		
Free height	49.8 (1.961)	48.8 (1.921)
Load/installed height N (kg, lbs.)/mm (in.)	329 (32.9, 73)/40.4 (1.591)	
Out-of-squareness	Max. 2°	4°
Valve guide		
Overall length		
Intake	47 (1.85)	
Exhaust	52 (2.05)	
I.D.	8.00 – 8.02 (0.3150 – 0.3157)	
O.D.	13.06 – 13.07 (0.5142 – 0.5146)	
Service size	0.05 (0.002), 0.25 (0.010), 0.50 (0.020) oversize	
Press-in temperature	Room temperature	
Valve seat		
Seat angle	45°	
Valve contact width		
Intake	0.9 – 1.3 (0.035 – 0.051)	
Exhaust	1.2 – 1.6 (0.047 – 0.063)	
Sinkage		0.2 (0.0079)
Service size	0.3 (0.012), 0.6 (0.024) oversize	
Jet valve		
Overall height	92.53 (3.6429)	
Stem diameter	4.3 (0.169)	
Face angle	45°	
Jet valve spring		
Free height	29.60 (1.1654)	
Load/installed height N (kg, lbs.)/mm (in.)	35 (3.5, 7.7)/21.5 (0.846)	

	Nm	Torque kgm	Nm
Timing chain			
Crankshaft bolt	120	12	87
Timing chain case bolt	14	1.4	10
Chain guide access hole cover bolt	11	1.1	8
Chain guide "B" bolt			
Upper	12	1.2	9
Lower	19	1.9	13
Chain guide "A" and "C" bolt	11	1.1	8
Oil pump sprocket bolt			
Engine with silent shaft	65	6.5	47
Engine without silent shaft	35	3.5	25
Silent shaft sprocket bolt	65	6.5	47
Loose side and tension side chain guide bolt	16	1.6	11
Sprocket holder bolt	16	1.6	11
Oil pump and silent shaft			
Oil relief valve plug	38	3.8	27
Oil pump bolt	11	1.1	8
Right silent shaft bolt	65	6.5	47
Thrust plate bolt	11	1.1	8
Piston and connecting rod			
Connecting rod bearing cap nut	47	4.7	34
Crankshaft, flywheel and drive plate			
Flywheel and drive plate bolt	135	13.5	98
Oil seal case bolt	11	1.1	8
Bearing cap bolt	80	8.0	58
Cylinder block			
Engine support bracket bolt	55	5.5	40
Oil pressure switch	19	1.9	13
Silent shaft chamber cover bolt	6	0.6	4

Tool	Number	Name	Use
	MD998250	Silent shaft bearing installer	Installation of silent shaft rear bearing
	MD998251	Silent shaft bearing pulley	Removal of silent shaft rear bearing
	MD998308	Jet valve stem seal installer	Installation of jet valve stem seal oil seal
	MD998309	Jet valve spring pliers	Compression of jet valve spring
	MD998310	Jet valve socket wrench	Removal and installation of jet valve
	MD998376	Crankshaft rear oil seal installer	Installation of crankshaft rear oil seal
	MD998440	Leak-down tester	Leak-down test of lash adjuster



SERVICE POINTS OF INSTALLATION

▶A◀ INSTALLATION OF GASKET / OIL PAN

- (1) Clean both gasket surfaces of cylinder block and oil pan.
- (2) If chain case gaskets protrude from cylinder block bottom surface, remove such portions using a knife.
- (3) Apply sealant to cylinder block bottom where it joins with chain case and rear oil seal case.

Specified sealant:

3M ATD Part No. 8660 or equivalent

- (4) Install oil pan with gasket. Tighten bolts in diagonal order beginning at end. Use care not to overtighten as it could force gasket out, resulting in oil leaks.

▶B◀ APPLICATION OF SEALANT ON SEMI-CIRCULAR PACKING

Specified sealant:

3M ATD Part No. 8660 or equivalent

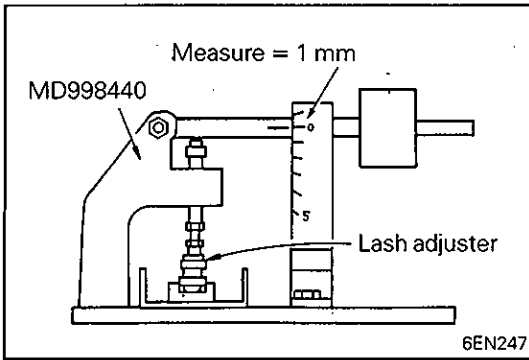
▶C◀ INSTALLATION OF WATER OUTLET FITTING GASKET FOR RUBBER COATED METAL GASKET ONLY

- (1) Install the water outlet fitting gasket with its "UP" mark facing up (toward the water outlet fitting side).

▶D◀ APPLICATION OF SEALANT TO COOLANT TEMPERATURE GAUGE UNIT

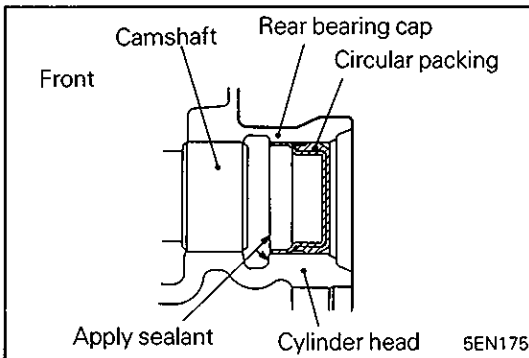
Specified sealant:

3M ATD Part No. 8660 or equivalent



- (4) After air bleeding, set lash adjuster on the special tool (Leak Down Tester MD998440).
- (5) After plunger has gone down somewhat (0.2 to 0.5 mm), measure time taken for it to go down 1 mm. Replace if measured time is out of specification.

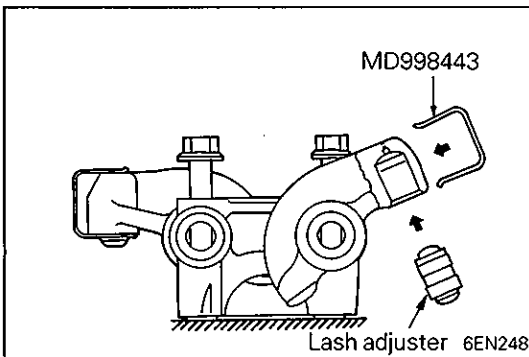
Standard value: 4 to 20 seconds / 1 mm (0.04 in.)
[Diesel fuel at 15 to 20°C (59 to 68°F)]



SERVICE POINTS OF INSTALLATION

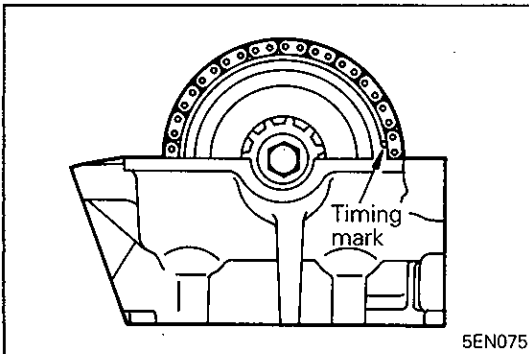
◆A◆ INSTALLATION OF CIRCULAR PACKING

- (1) Apply specified sealant to outer surface of circular packing.
Specified sealant:
3M ATD Part No. 8660 or equivalent
- (2) Set circular packing on cylinder head as illustrated and install cam cap.



◆B◆ INSTALLATION OF LASH ADJUSTER

- (1) Insert lash adjuster from below as illustrated, using care not to spill diesel fuel from inside of adjuster. Then, install the special tool to prevent adjuster from dropping.



◆C◆ ADJUSTMENT OF JET VALVE CLEARANCE (ENGINE WITH JET VALVE ONLY)

- (1) Set the No. 1 piston at top dead center on the compression stroke.
 Turn the crankshaft clockwise until the notch on pulley is lined up with the "T" mark on timing chain cover.
 In this state, check that the mating mark on the camshaft sprocket is at the position shown in the illustration.

Caution

- Do not turn the crankshaft counterclockwise.

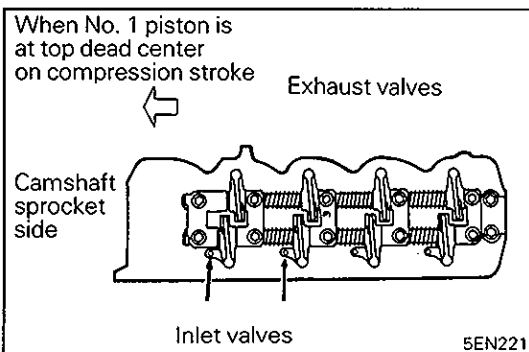
NOTE

If the mating mark is at the opposite side, No. 4 piston is at top dead center on the compression stroke.

- (2) Measure the jet valve clearance at points indicated by arrows.

Standard value (on cold engine):
0.17 mm (0.007 in)

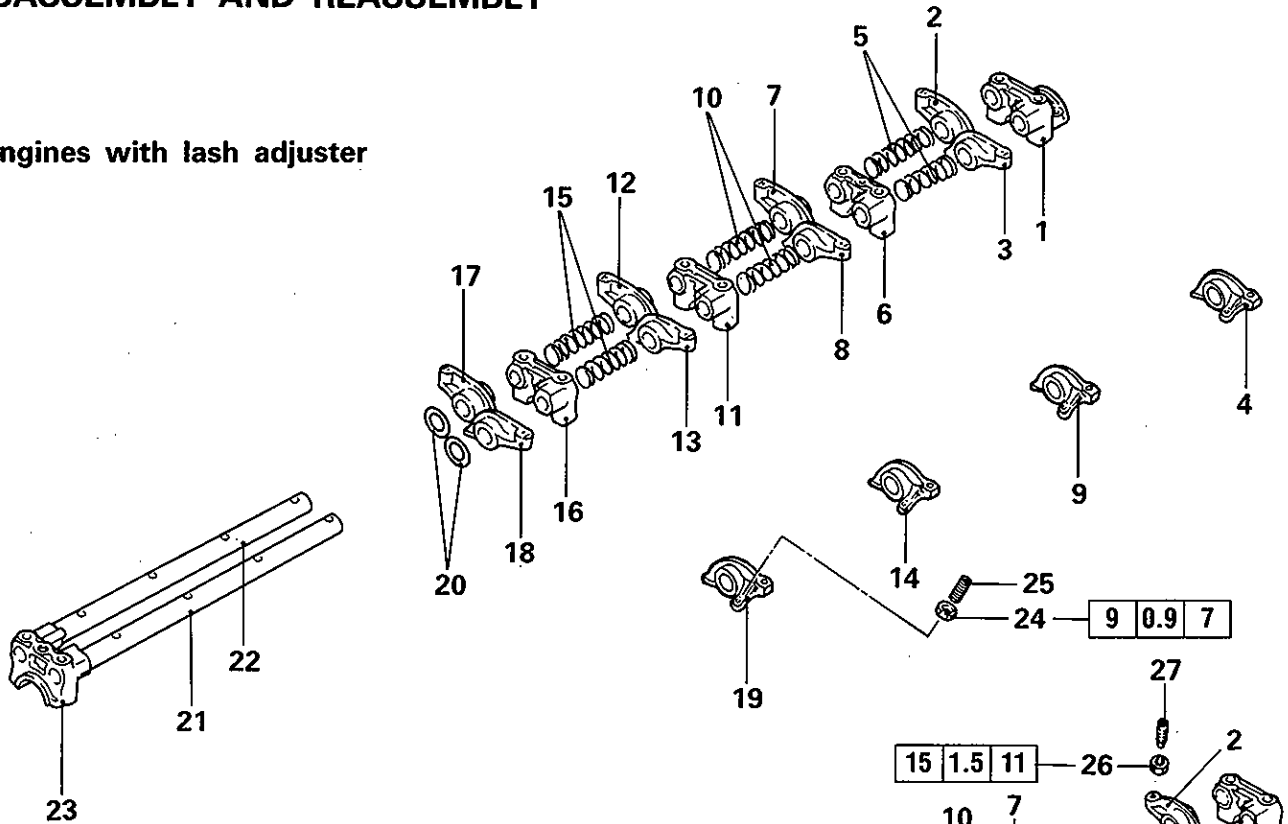
- (3) If the jet valve clearance is not as specified, loosen the lock nut and adjust the clearance using a feeler gauge while turning the adjusting screw.



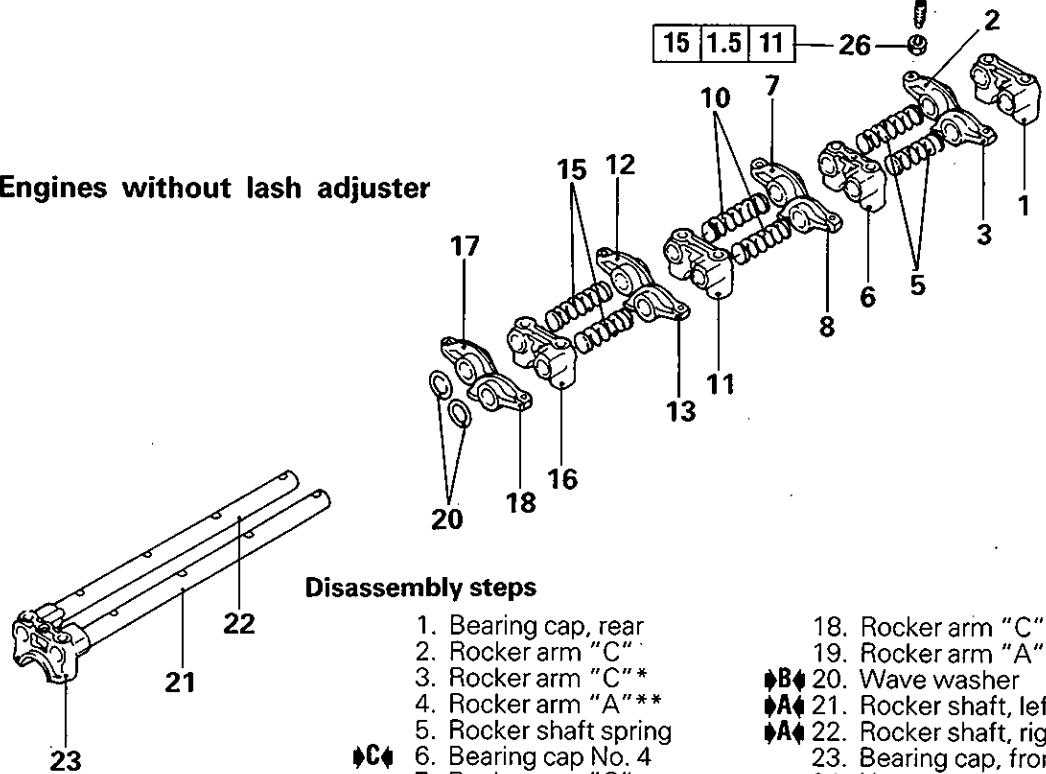
6. ROCKER ARMS AND ROCKER SHAFTS

DISASSEMBLY AND REASSEMBLY

Engines with lash adjuster



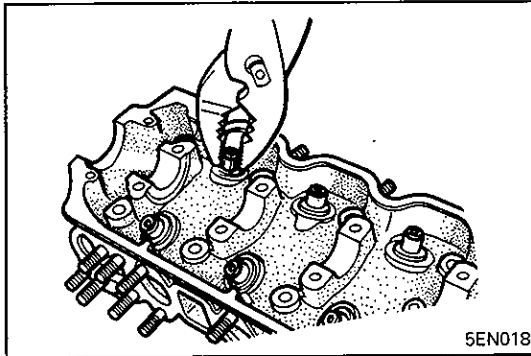
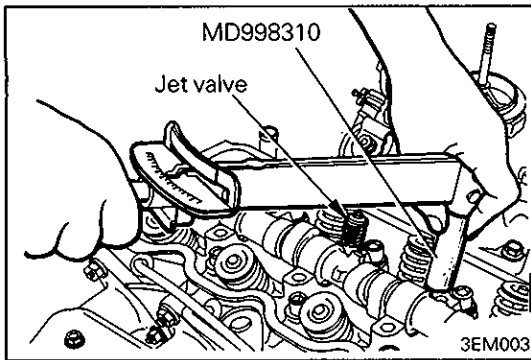
Engines without lash adjuster



Disassembly steps

1. Bearing cap, rear
2. Rocker arm "C"
3. Rocker arm "C"
4. Rocker arm "A"
5. Rocker shaft spring
6. Bearing cap No. 4
7. Rocker arm "C"
8. Rocker arm "C"
9. Rocker arm "A"
10. Rocker shaft spring
11. Bearing cap No. 3
12. Rocker arm "C"
13. Rocker arm "C"
14. Rocker arm "A"
15. Rocker shaft spring
16. Bearing cap No. 2
17. Rocker arm "C"
18. Rocker arm "C"
19. Rocker arm "A"
20. Wave washer
21. Rocker shaft, left
22. Rocker shaft, right
23. Bearing cap, front
24. Nut
25. Adjusting screw
26. Nut
27. Adjusting screw

NOTE
 *: Engines without jet valve
 **: Engines with jet valve
 ***: Engines without lash adjuster



SERVICE POINTS OF REMOVAL

PRECAUTION FOR REMOVED PARTS

- (1) Keep removed parts in order according to the cylinder number and intake / exhaust.

◁A▷ REMOVAL OF JET VALVE ASSEMBLY

- (1) Use the special tool to remove jet valves.
- (2) For identification, put the corresponding cylinder number to the removed jet valves.

Caution

- When loosening a jet valve, hold the special tool securely so that it is not tilted with respect to the jet valve center line. Also avoid abruptly applying force.

◁B▷ REMOVAL OF VALVE STEM SEAL

To remove valve stem seal, use pliers.

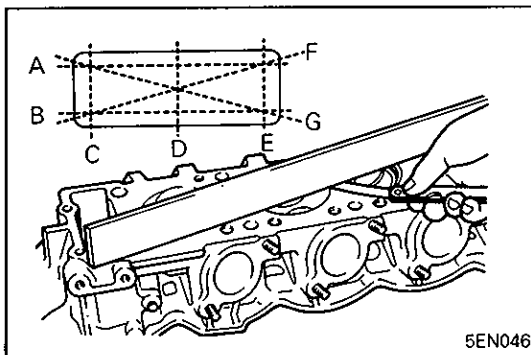
NOTE

Do not reuse valve stem seal.

INSPECTION

CYLINDER HEAD

- (1) Check the cylinder head, before cleaning, for water leaks, gas leaks, damage, and cracks.
- (2) Remove oil, scale, sealing compound, and carbon deposits completely. After cleaning oil passages, apply compressed air to ensure that the passages are not clogged.



- (3) Check the cylinder head gasket surface for flatness by using a straightedge in the directions of A through G shown in illustration.

Standard value: 0.05 mm (0.0020 in.)

Limit: 0.2 mm (0.008 in.)

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

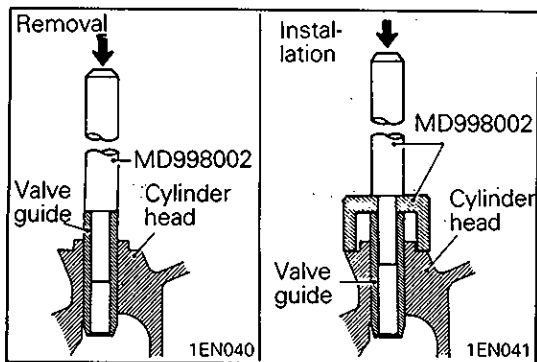
Grinding limit: 0.2 mm (0.008 in.)

Caution

- The total thickness of the stock allowed to be removed from cylinder head and mating cylinder block is 0.2 mm (0.008 in.).

Cylinder head height (when new):

89.9 – 90.1 mm (3.539 – 3.547 in.)



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.: 13.050 – 13.068 mm
(0.5138 – 0.5145 in.)

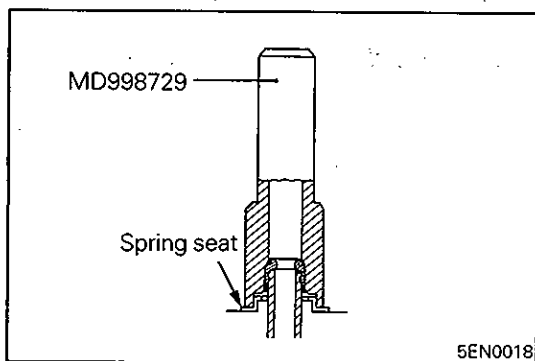
0.25 O.S.: 13.250 – 13.268 mm
(0.5217 – 0.5224 in.)

0.50 O.S.: 13.500 – 13.518 mm
(0.5315 – 0.5322 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.



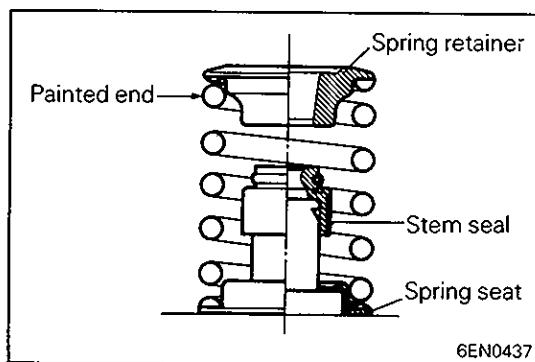
SERVICE POINTS OF INSTALLATION

◆A◆ INSTALLATION OF VALVE STEM SEAL

- (1) Install the valve spring seat.
- (2) Using the special tool, install a new stem seal to the valve guide.

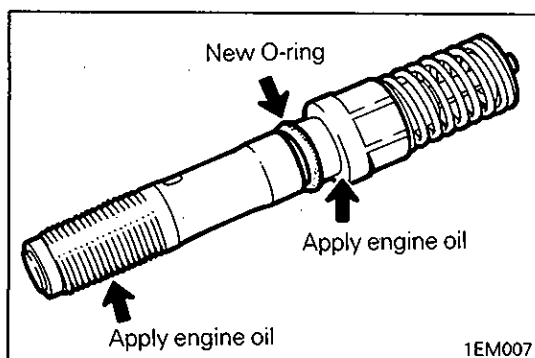
Caution

- Do not reuse the valve stem seal.



◆B◆ INSTALLATION OF VALVE SPRING

- (1) Direct the valve spring end with identification color to the spring retainer.

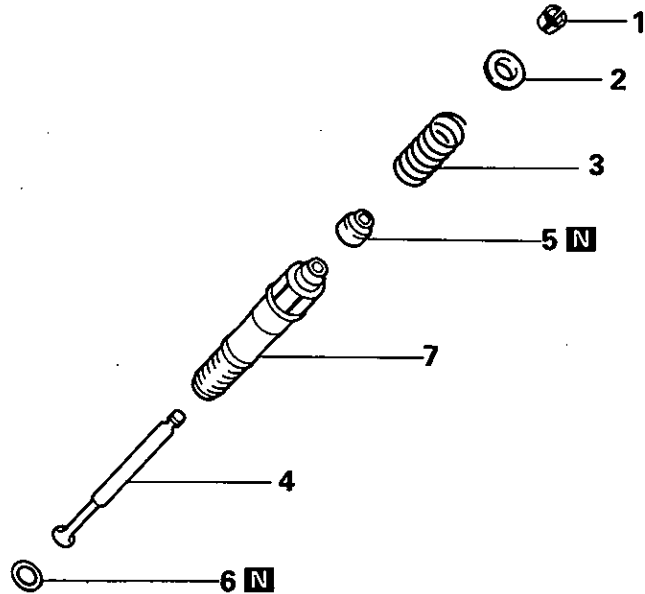


◆C◆ INSTALLATION OF JET VALVE ASSEMBLY

- (1) Install a new O-ring to the jet valve body.
- (2) Apply engine oil to threads and seat surface of jet body.

8. JET VALVE ASSEMBLY (ENGINE WITH JET VALVES)

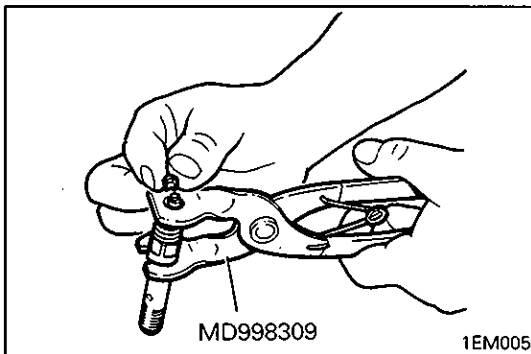
DISASSEMBLY AND REASSEMBLY



Disassembly steps

- ◀A▶ ▶B▶ 1. Retainer lock
 2. Valve spring retainer
 3. Valve spring
 ▶A▶ 4. Jet valve
 5. Stem seal
 6. O-ring
 7. Jet body

1EM177



SERVICE POINTS OF DISASSEMBLY

◀A▶ REMOVAL OF RETAINER LOCK

- (1) Using the special tool, compress the valve spring and remove the retainer lock.

NOTE

Keep disassembled parts neatly arranged for each cylinder.

INSPECTION

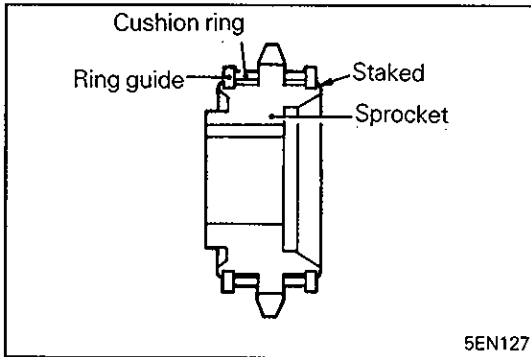
- Insert a jet valve into jet body and check for sliding conditions. If it does not slide smoothly, or too loose in the body, replace.

NOTE

Replace jet valve and jet body as an assembly.

SERVICE POINTS OF REMOVAL**◀A▶ REMOVAL OF TIMING CHAIN / CAMSHAFT SPROCKET / CRANKSHAFT SPROCKET**

- (1) Remove crankshaft sprocket, camshaft sprocket and timing chain together.

**INSPECTION****SPROCKETS**

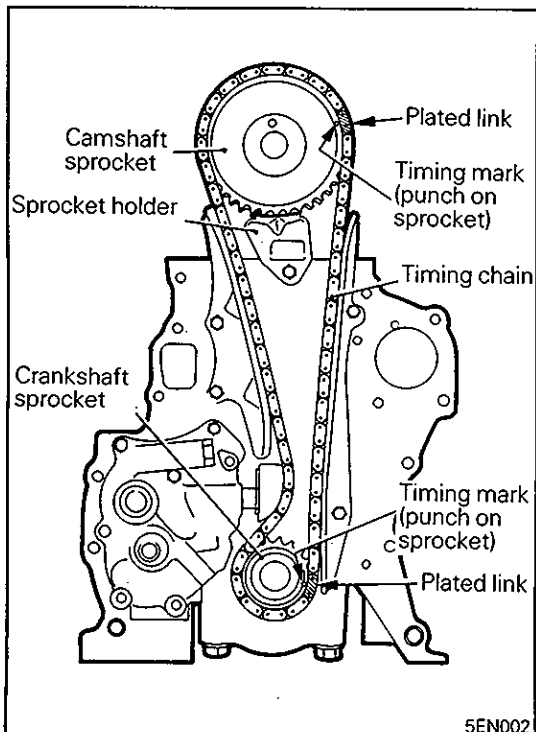
- (1) Check teeth of sprocket for wear or damage.
- (2) Check silent shaft sprocket for damaged cushion ring and ring guide. Check to ensure that cushion ring smoothly rotates.

CHAINS

- (1) Check chain for roller play, wear, damage or disconnected links.

CHAIN TENSIONER AND GUIDES

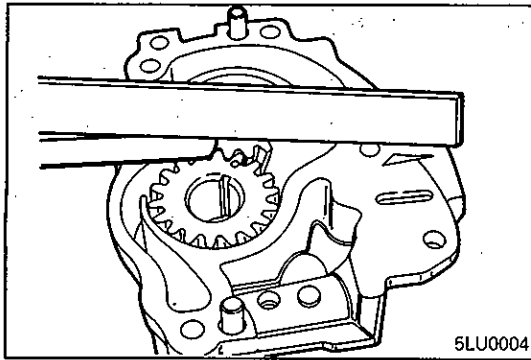
- (1) Check chain tensioner and guide rubber shoe for wear or damage.

**SERVICE POINTS OF INSTALLATION****▶A▶ INSTALLATION OF TENSIONER SPRING / RUBBER SEAT / TENSIONER SLEEVE**

- (1) Install tensioner spring, sleeve and rubber seat to oil pump.

▶B▶ INSTALLATION OF TIMING CHAIN

- (1) Turn crankshaft until piston of No. 1 cylinder is at top dead center.
- (2) Line up plated links of timing chain and timing marks on sprockets as chain and sprockets are assembled.
- (3) While sliding crankshaft sprocket onto crankshaft, install chain and sprocket. Place camshaft sprocket on sprocket holder.



- (3) Check the driven gear side clearance.

Standard value:

0.04 – 0.10 mm (0.0016 – 0.0039 in.)

Limit: 0.15 mm (0.006 in.)

- (4) Check gear contacting surface of cover for ridge wear. If clearance is excessively large or if case or cover has ridge wear, replace case and cover assembly and/or gears.

SILENT SHAFT

- (1) Check oil holes for clogging.
- (2) Check journal for seizure, damage, and contact with bearing. If defects are evident, replace the silent shaft, bearing, or thrust plate.
- (3) Check the silent shaft oil clearance. If wear is excessive, replace the silent shaft bearing, silent shaft, or thrust plate.

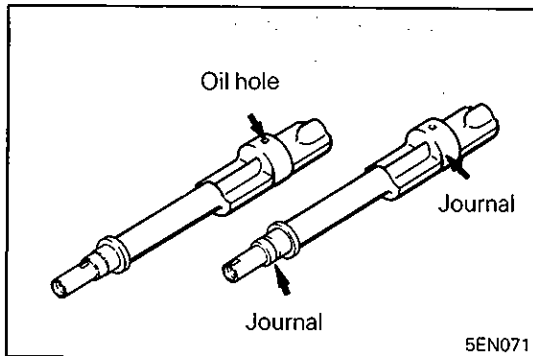
Standard value:

Front (left only)

0.02 – 0.06 mm (0.0008 – 0.0024 in.)

Rear

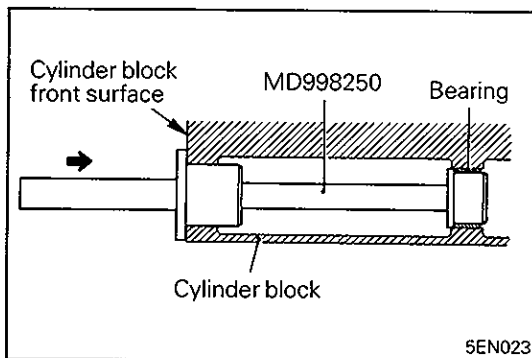
0.10 – 0.13 mm (0.0039 – 0.0051 in.)



SERVICE POINTS OF INSTALLATION

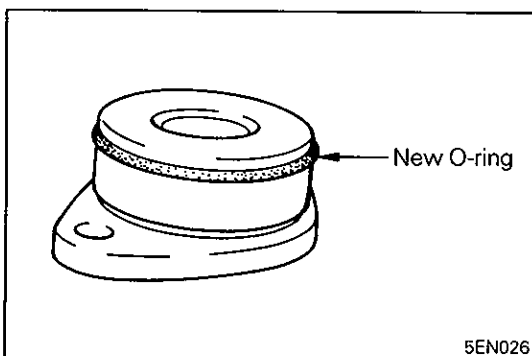
◆A◆ INSTALLATION OF SILENT SHAFT REAR BEARING

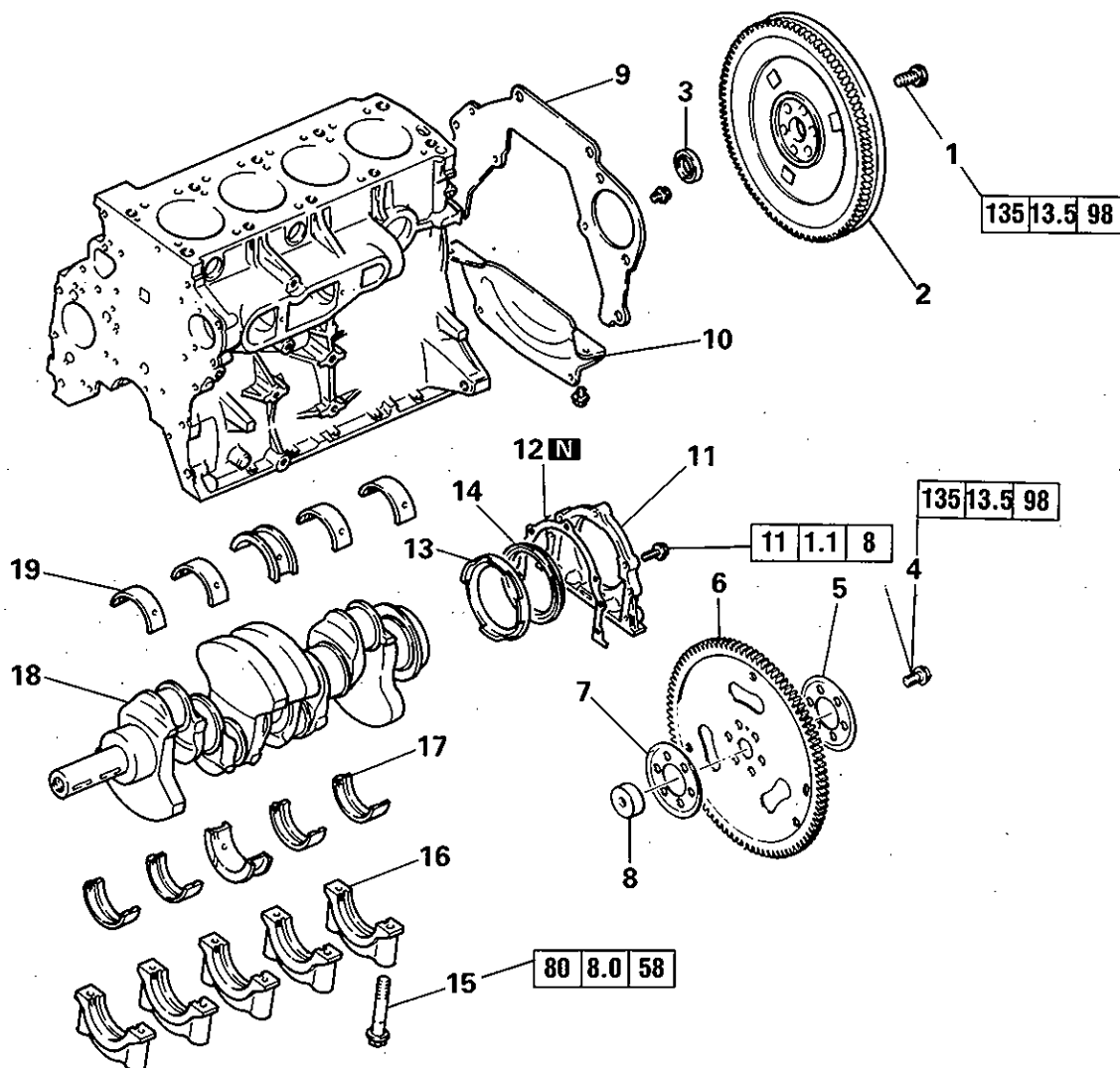
- (1) Apply engine oil to the rear bearing outer circumference and bearing hole in cylinder block.
- (2) Using the special tool and a hammer, drive the rear bearing into cylinder block.



◆B◆ INSTALLATION OF O-RING

- (1) Install new O-ring in groove of thrust plate. Apply engine oil around O-ring.



13. CRANKSHAFT, FLYWHEEL AND DRIVE PLATE**REMOVAL AND INSTALLATION****Removal steps**

1. Flywheel bolt
2. Flywheel
3. Ball bearing
4. Drive plate bolt
5. Adapter
6. Drive plate
7. Adapter
8. Crankshaft bushing
9. Rear plate
10. Bell housing cover
11. Oil seal case
12. Gasket
- ▶E▶ 13. Separator
- ▶D▶ 14. Rear oil seal
15. Bearing cap bolt
- ▶C▶ 16. Bearing cap
- ▶B▶ 17. Crankshaft bearing (lower)
18. Crankshaft
- ▶A▶ 19. Crankshaft bearing (upper)