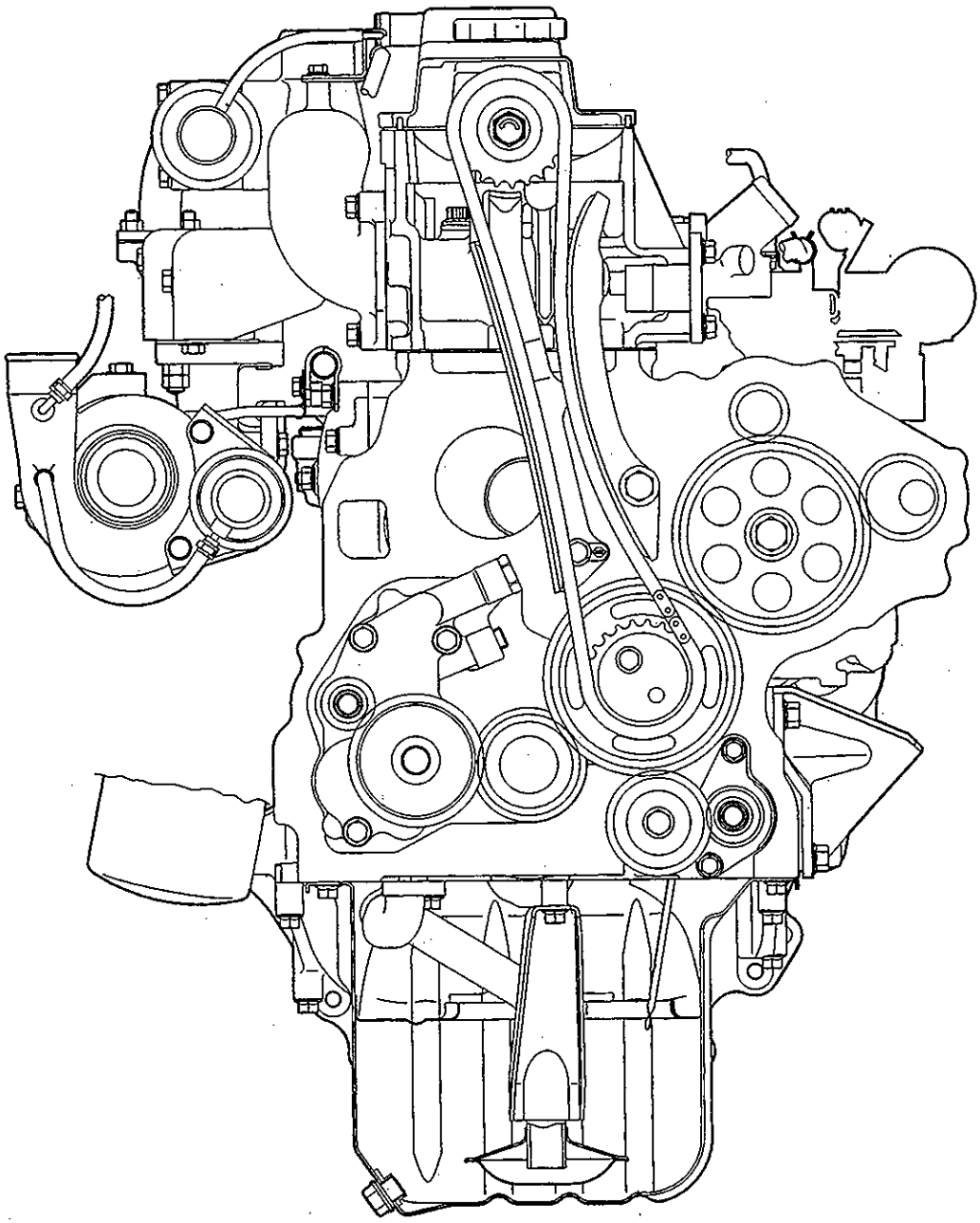
ENGINE
4M40

CONTENTS

GENERAL INFORMATION

SECTIONAL VIEW

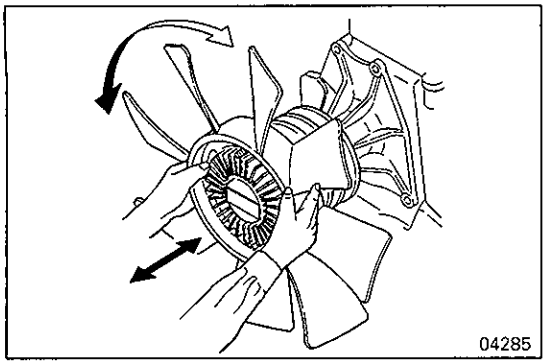


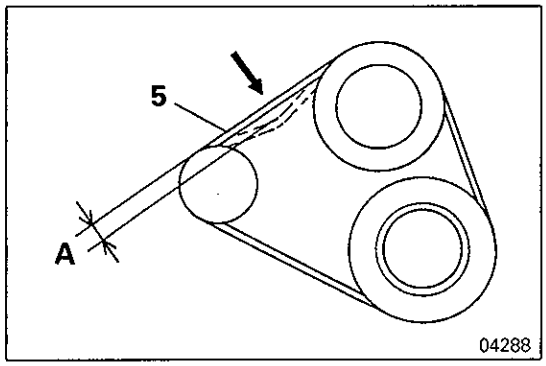
4ME0001

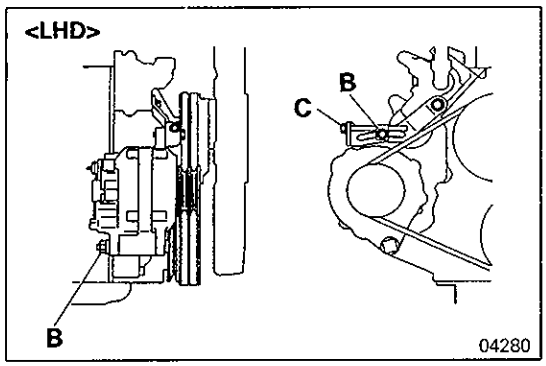
TORQUE SPECIFICATION

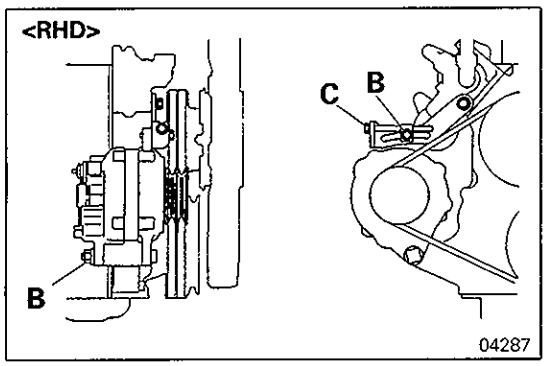
	Torque		
	Nm	kgm	ft.lbs.
Cooling fan V-belt and water pump			
Cooling fan nut	10	1.0	7
Auto-cooling fan coupling nut	24	2.4	17
Water pump bolt	24	2.4	17
Water hoses and pipes			
Turbocharger water outlet pipe	26	2.6	19
Turbocharger water inlet pipe	26	2.6	19
Engine coolant temperature sensor	9	0.9	7
Coolant temperature sensor			
Coolant temperature sensor	40	4.0	29
Glow plug			
Connection plate	10*1, 1.8*2	1.0*1, 0.18*2	7*1, 1.3*2
Glow plug	18	1.8	13
Turbocharger assembly			
Eyebolt	20	2.0	14
Coupler insulator nut	50	5.0	36
Turbocharger nut	50	5.0	36
Turbocharger bolt	55	5.5	40
Turbocharger water outlet pipe	26	2.6	19
Turbocharger water inlet pipe	26	2.6	19
Turbocharger			
Coupling nut	4.5	0.45	3.3
Intake manifold			
Relief valve	48	4.8	35
Exhaust manifold			
Exhaust manifold bolt	30	3.0	22
Exhaust manifold nut	31	3.1	22
Rocker cover and cylinder head assembly			
Rocker cover bolt	4	0.4	3
Cam sprocket bolt ... Left-hand thread	90	9.0	65
Cylinder head bolt			
M12	50 + 1/4 turns + 1/4 turns	5.0 + 1/4 turns + 1/4 turns	36 + 1/4 turns + 1/4 turns
M8	24	2.4	17
Camshaft and valve			
Camshaft cap bolt	20	2.0	14
Glow plug	18	1.8	13
Fuel injection nozzle	55	5.5	40
Water joint	48	4.8	35
Oil cooler and oil filter			
Oil cooler element nut	20	2.0	14
Bypass plug	45	4.5	33
Regulator plug	45	4.5	33
Turbocharger water inlet pipe	26	2.6	19

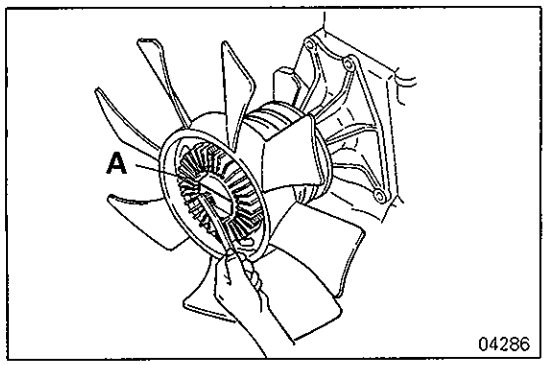
NOTE
*1: Except PAJERO 2001Model
*2: PAJERO 2001Model











INSPECTION

AUTO-COOLING FAN COUPLING

(1) Check the auto-cooling fan coupling **4**, and replace if any of the following conditions exists:
   (a) Hydraulic fluid is leaking from the hermetically sealed housing.
   (b) The coupling turns irregularly or produces an abnormal sound when rotated by hand due to defective inside bearing.
   (c) The coupling has an excessive axial play when moved with the engine in a cold state.

V-BELT

(1) Push the V-belt **5** at its midpoint with a force of approximately 98 N (10 kg, 22 lbs.) as shown and read the amount of deflection **A**.
(2) If the reading deviates from the specified standard value, accomplish the following adjustment.

(3) Loosen the bolt and nut **B** holding the generator, and adjust the tension of the V-belt **5** using the adjusting bolt **C**.

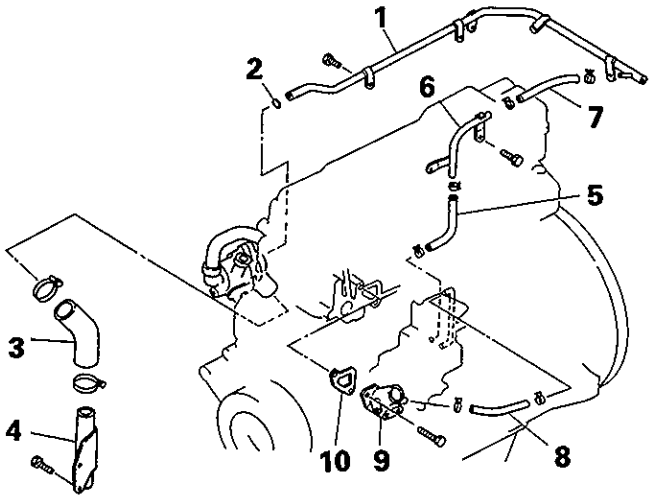
Caution
- **Be sure to retighten the bolt and nut securely after the adjustment.**
- **Excessive tension damages not only the V-belt 5 itself but bearings elsewhere.**
- **Be sure to replace the V-belt 5, when necessary, in pairs and keep it slush-free.**

CLEANING

(1) Remove foreign matters, if any, from the bimetal **A** using care not to apply unnecessary force to it.

6. WATER HOSES AND PIPES

REMOVAL AND INSTALLATION (FOR L200 and PAJERO except 1998– model for Europe)



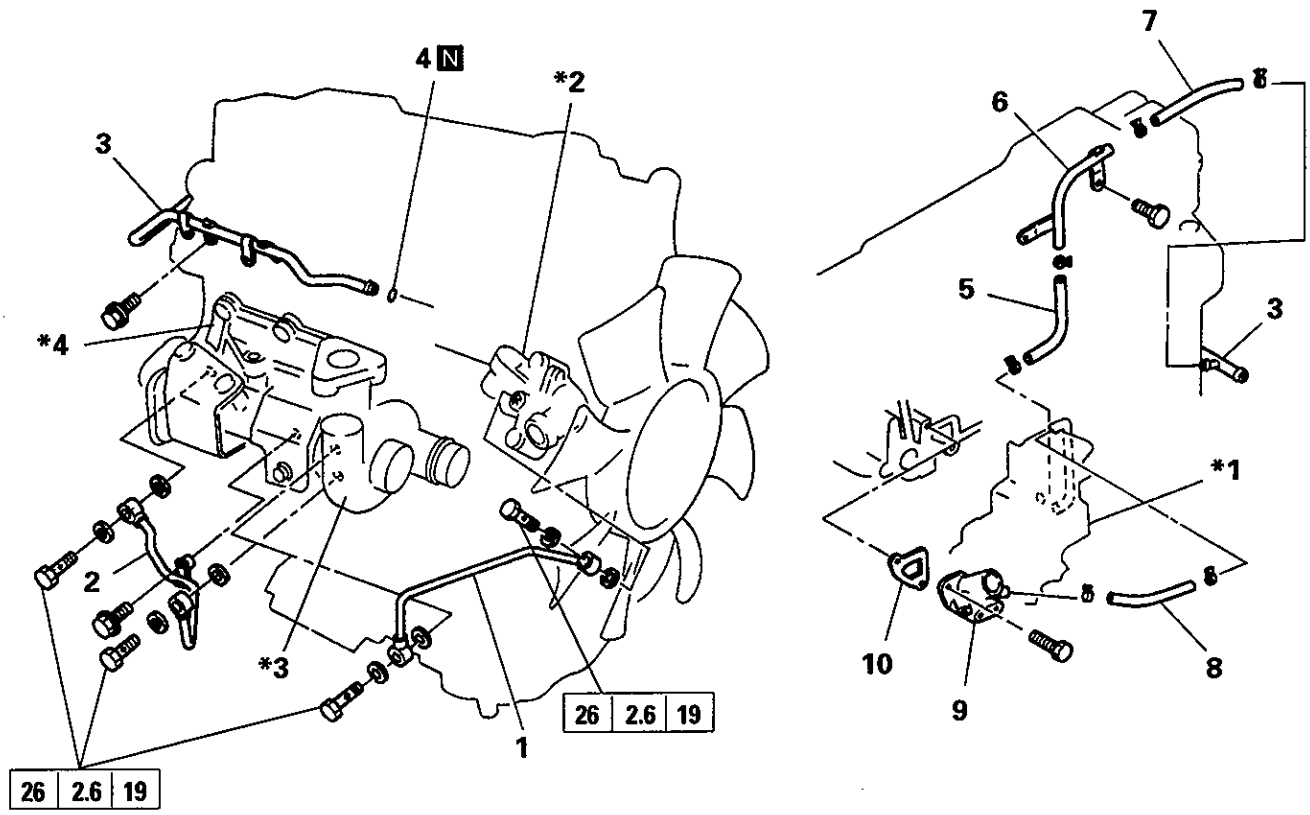
Removal steps

1. Heater return pipe
◆A◆ 2. O-ring
3. Water inlet hose
4. Water inlet pipe
5. Water hose <with W-CSD>
6. Water pipe <with W-CSD>
7. Water hose <with W-CSD>
8. Water hose <with W-CSD>
9. Water outlet pipe
10. Gasket

NOTE
W-CSD: Wax type cold start device

04291

REMOVAL AND INSTALLATION (FOR CHALLENGER)



Removal steps

1. Turbocharger water outlet pipe
2. Turbocharger water inlet pipe
3. Heater return pipe

◆A◆ 4. O-ring

◆B◆ 5. Water hose

6. Water pipe

◆B◆ 7. Water hose

◆B◆ 8. Water hose

9. Water outlet pipe

10. Gasket

*1: Injection pump assembly
*2: Thermostat assembly (See page 11A-5-1.)
*3: Turbocharger assembly (See page 11A-9-2.)
*4: Oil cooler assembly (See page 11A-15-1.)

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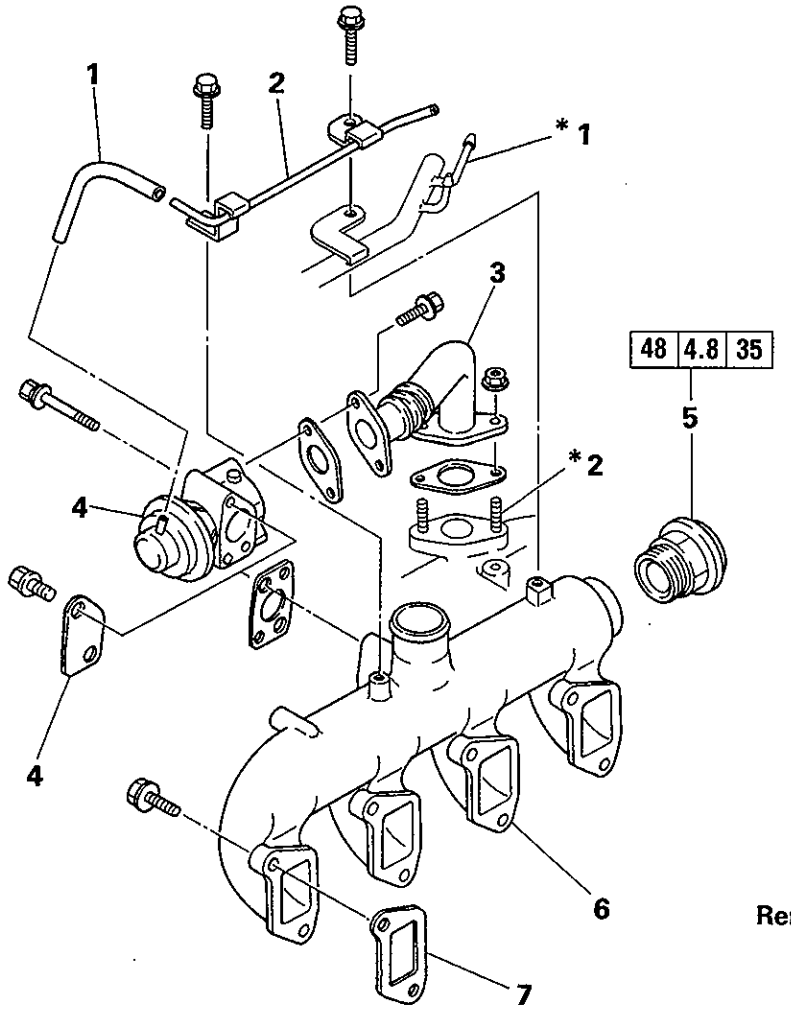
11. INTAKE MANIFOLD

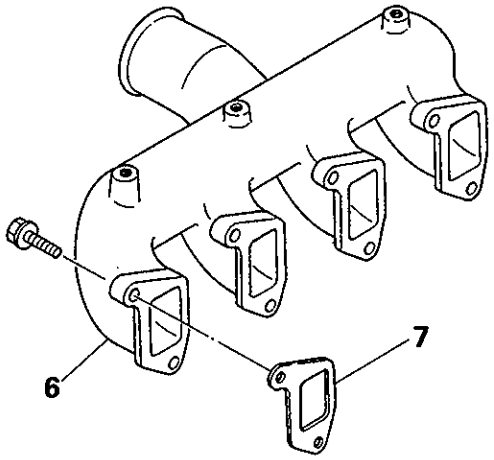
REMOVAL AND INSTALLATION

<Turbo: EXCEPT PAJERO 2001MODEL>



04317

<Non-turbo>

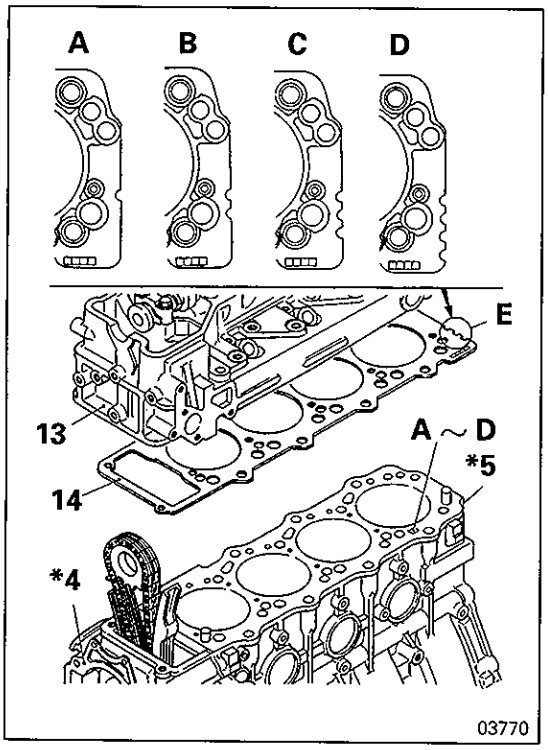


04316

Removal steps

1. Vacuum hose <with EGR>
2. Vacuum pipe <with EGR>
3. EGR pipe <with EGR>
4. EGR valve <with EGR>
   Cover <without EGR>
5. Relief valve
6. Intake manifold
7. Gasket

*1. Vacuum pipe
*2. Exhaust manifold



〈B〉 CYLINDER HEAD GASKET REMOVAL

Caution

- **Remove the cylinder head gasket 14 using care not to scratch the cylinder head assembly 13, crankcase assembly *5 and timing gear case assembly *4.**

INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

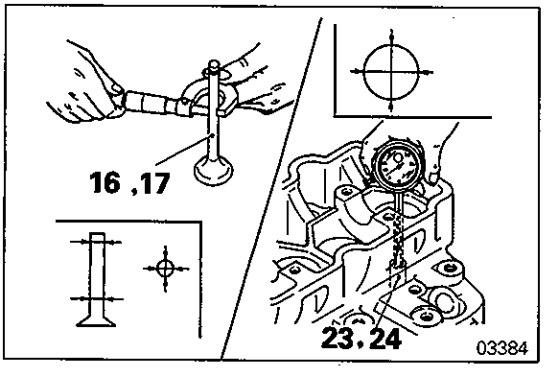
(1) Choose a cylinder head gasket **14** having an appropriate thickness that meets the piston protrusion. The following thicknesses of gaskets are available. They are identified by the notches at an end of the gasket.
Measure the piston protrusions and calculate their average, and select an appropriate gasket thickness from the following table.
If a piston protrudes 0.03 mm larger than the average, use one-size thicker gasket.

PAJERO

Piston protrusion		Cylinder head gasket	
Average piston protrusion	Crankcase identification mark	Classification	Thickness when tightened
0.475 ± 0.028 mm (0.0187 ± 0.0011 in.)	A	A (1 notch)	1.35 ± 0.03 mm (0.0531 ± 0.0012 in.)
0.532 ± 0.028 mm (0.0209 ± 0.011 in.)	B	B (2 notches)	1.40 ± 0.03 mm (0.0551 ± 0.0012 in.)
0.589 ± 0.028 mm (0.0232 ± 0.011 in.)	C	C (3 notches)	1.45 ± 0.03 mm (0.0571 ± 0.0012 in.)
0.646 ± 0.028 mm (0.0254 ± 0.011 in.)	D	D (4 notches)	1.50 ± 0.03 mm (0.0591 ± 0.0012 in.)

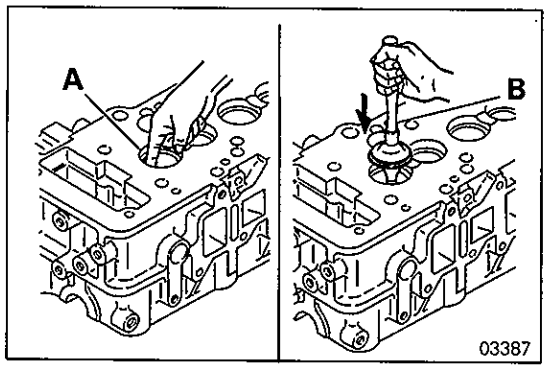
L200

Piston protrusion		Cylinder head gasket	
Average piston protrusion	Crankcase identification mark	Classification	Thickness when tightened
0.575 ± 0.028 mm (0.0226 ± 0.0011 in.)	A	A (1 notch)	1.35 ± 0.03 mm (0.0531 ± 0.0012 in.)
0.632 ± 0.028 mm (0.0249 ± 0.011 in.)	B	B (2 notches)	1.40 ± 0.03 mm (0.0551 ± 0.0012 in.)
0.689 ± 0.028 mm (0.0271 ± 0.011 in.)	C	C (3 notches)	1.45 ± 0.03 mm (0.0571 ± 0.0012 in.)
0.746 ± 0.028 mm (0.0293 ± 0.011 in.)	D	D (4 notches)	1.50 ± 0.03 mm (0.0591 ± 0.0012 in.)



VALVE AND VALVE GUIDE

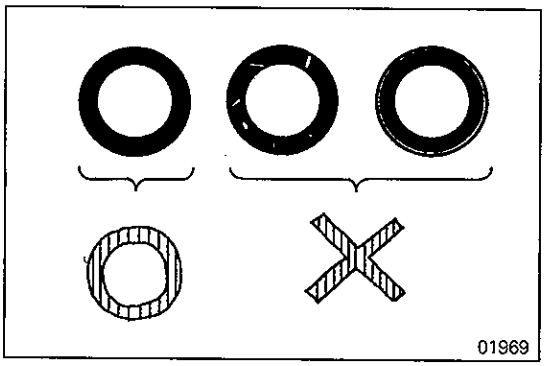
(1) If the clearance exceeds the specified service limit, replace the defective part.



VALVE AND VALVE SEAT

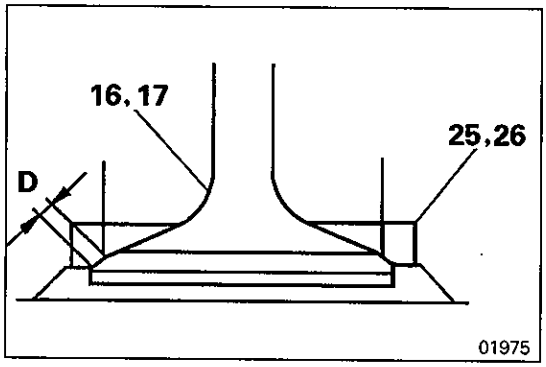
(1) Apply an even coat of minium to the valve seating surface **A** of the valve seat **25**, **26**.
(2) Strike the valve **16**, **17** against the valve seat **25**, **26** once while taking care that the valve is not rotated.
B: Valve Lapper

NOTE
Before proceeding with the contact check, examine the valve **16**, **17** and valve guide **23**, **24** in detail to see if they are in normal condition. (See 11A-14-5,6.)



(3) Determine the valve seating condition from minium pattern printed on the valve **16**, **17**. If any abnormal contact is found, take the following corrective action.

	Corrective action
Minor defect	Lap valve for better seating.
Major defect	Correct or replace valve and valve seat.

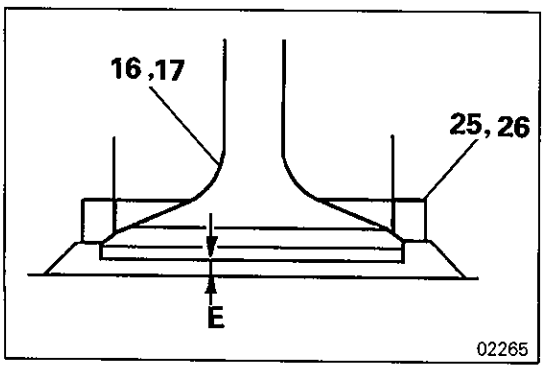


VALVE SEAT

Valve Seat Width

(1) If the specified service limit is exceeded, replace the valve seat **25**, **26**.
D: Valve seat width

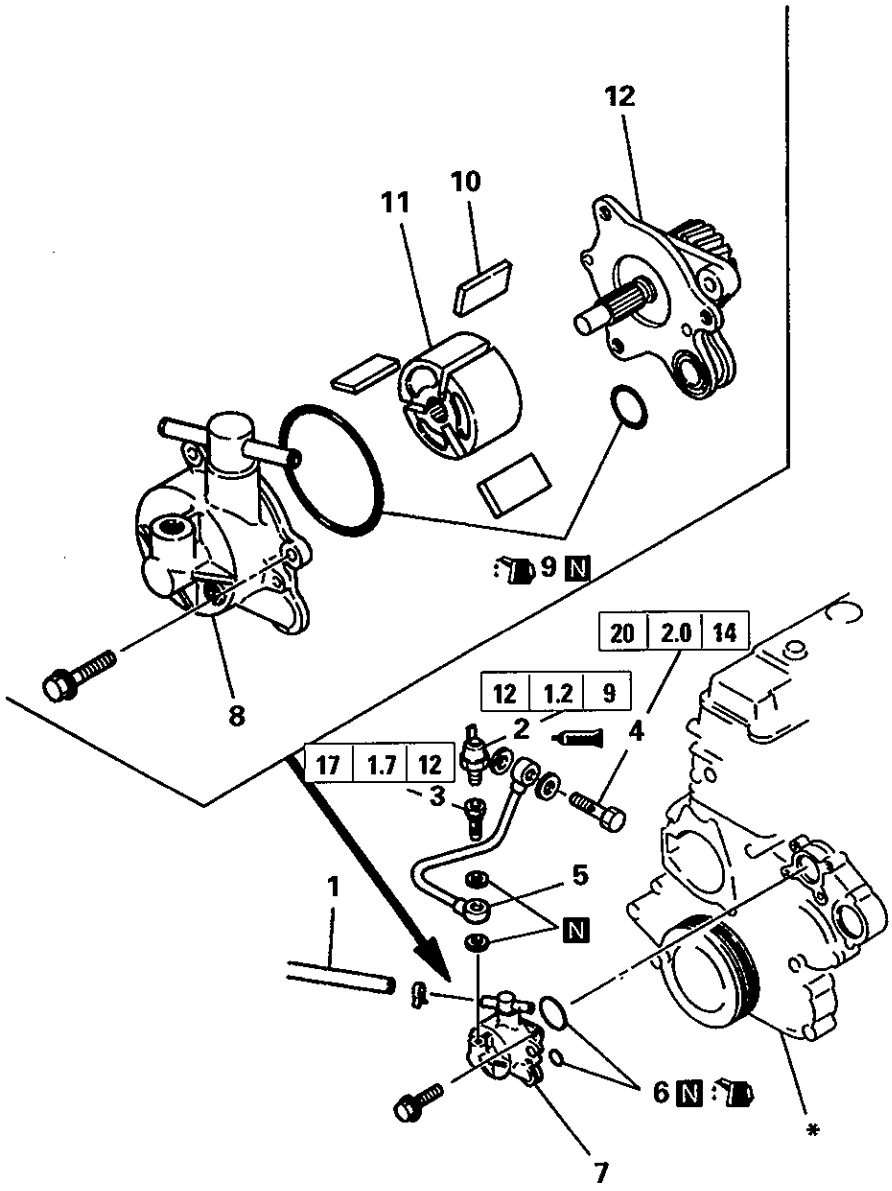
NOTE
When the valve seat **25**, **26** has been corrected or replaced, lap it and the valve **16**, **17** for proper seating. (See page 11A-14-6.)



Valve Sinkage from Cylinder Head Bottom

(1) If the specified service limit is exceeded, correct or replace the defective part.
E: Valve sinkage

REMOVAL AND INSTALLATION (1998– PAJERO for Europe)



Removal steps

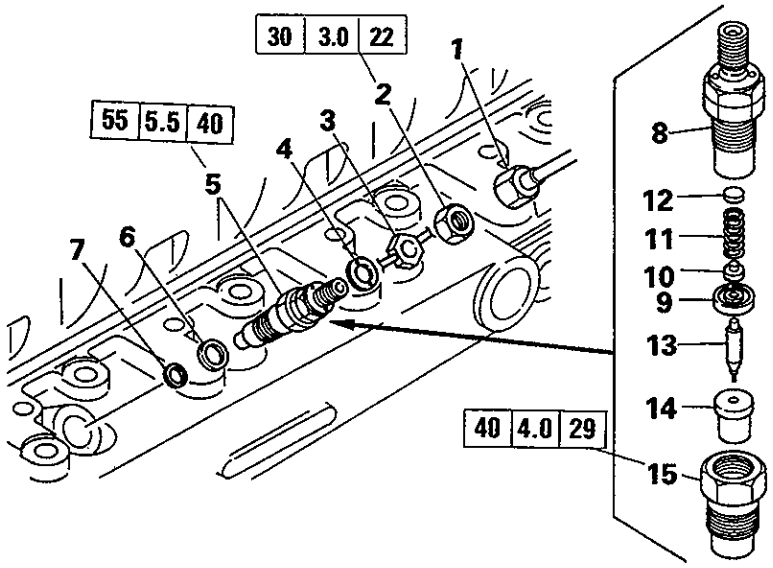
1. Air hose
◆A◆ 2. Oil pressure switch
3. Connector
4. Eyebolt
5. Oil pipe
6. O-ring
7. Vacuum pump assembly
8. Cylinder assembly
9. O-ring
10. Vane
11. Rotor
12. Flange assembly

*: Timing gear case (See 11A-18-1.)

4ME0368

21. FUEL INJECTION NOZZLE

REMOVAL AND INSTALLATION



Removal steps

1. Fuel injection pipe
2. Nut
3. Leak-off pipe
4. leak-off pipe gasket
◇A◇ 5. Fuel injection nozzle assembly
6. Nozzle holder gasket
7. Nozzle gasket
8. Body
9. Spacer
10. Push rod
11. Spring
12. Adjusting shim
◇B◇ 13. Needle valve
◇B◇ 14. Nozzle tip
15. Retaining nut

Part Assembly Sequence for Fuel Injection Nozzle Assembly **5**.

5: 8→12→11→10→9 / 15→14→13 →5

04008

INSPECTION

FUEL INJECTION NOZZLE ASSEMBLY

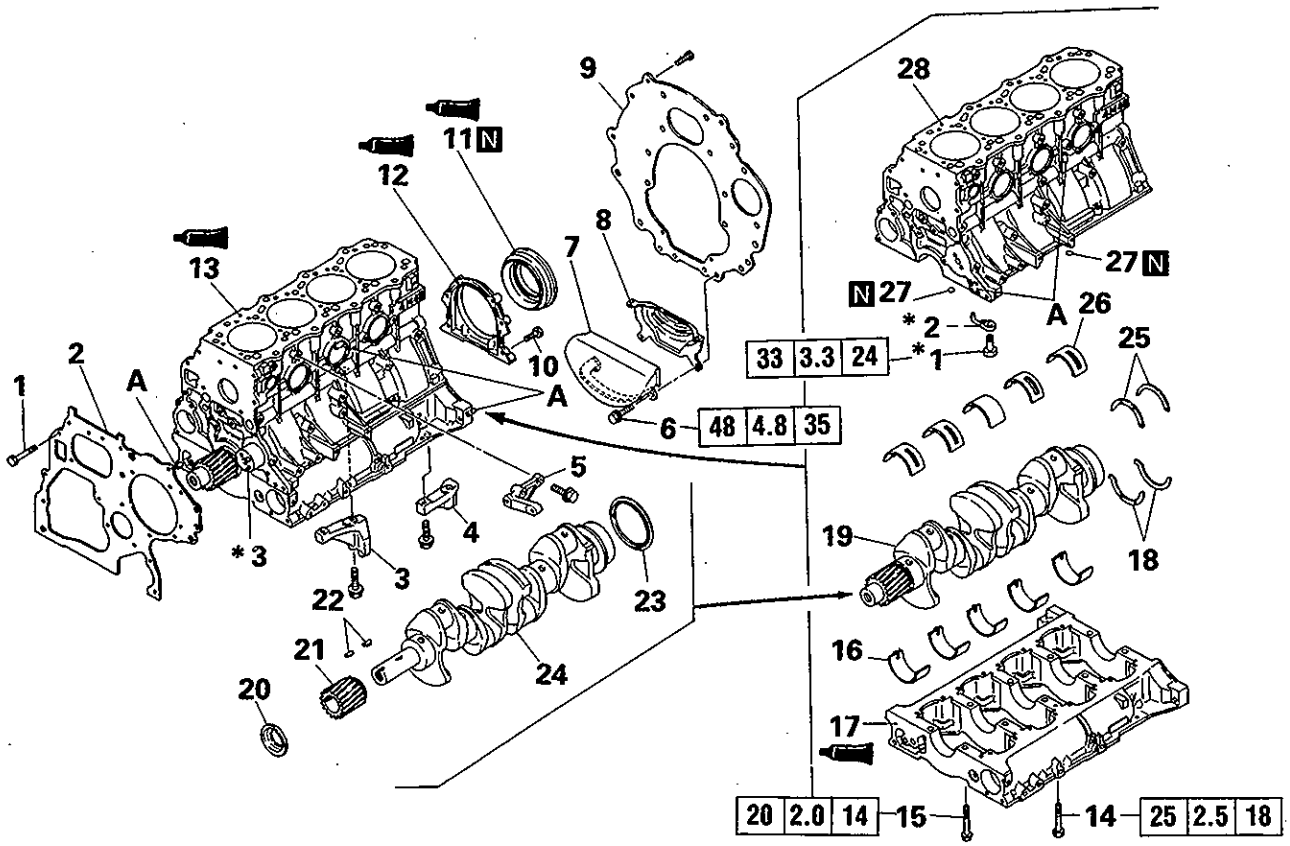
(1) Install the nozzle tester to the fuel injection nozzle assembly **5** and perform the following checks:

Caution

- **Prior to proceeding with the checks, bleed air from the fuel injection nozzle by pumping the nozzle tester lever two or three times.**

28. CRANKSHAFT AND CRANKCASE

REMOVAL AND INSTALLATION



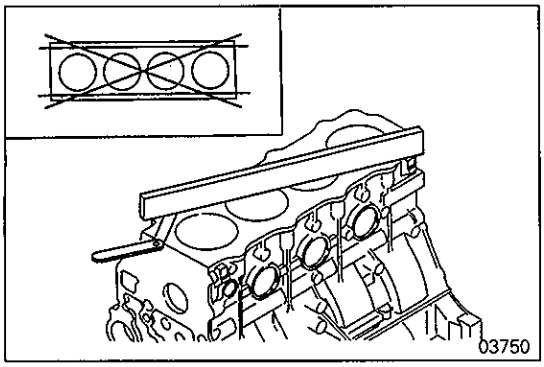
Apply engine oil to all moving parts before installation.

Removal steps

1. Bolt
◆G◆ 2. Front plate
3. Stiffener
4. Stiffener RH
5. Stiffener LH
6. Bolt
7. Rubber spacer
8. Dust cover
9. Rear plate
10. Bolt
◆H◆11. Rear oil seal
◆H◆12. Rear oil seal case
13. Crankcase assembly
◇A◇ ◆F◆14. Bolt
◇A◇ ◆F◆15. Main bearing cap bolt
◆D◆16. Lower main bearing
◆E◆17. Lower crankcase
◆C◆18. Lower thrust plate
19. Crankshaft assembly
20. Front oil seal slinger
◇B◇ ◆B◆21. Crankshaft gear
22. Key
◆A◆23. Rear oil seal slinger
24. Crankshaft
◆C◆25. Upper thrust plate
◆D◆26. Upper main bearing
27. O-ring
28. Upper crankcase

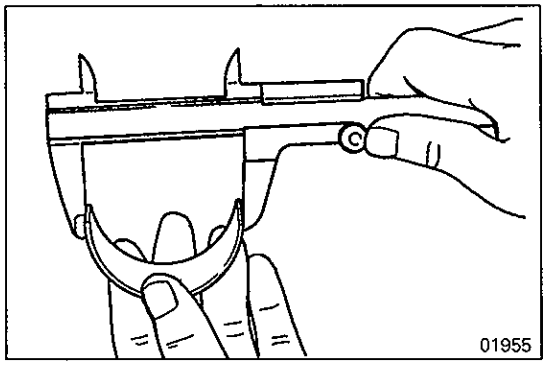
*1: Check valve (See page 11A-16-1.)
*2: Oil jet (See page 11A-16-1.)
*3: Idler shaft (See page 11A-19-1.)
A: Dowel pin

03738



UPPER CRANKCASE TOP DISTORTION

(1) If the measured value exceeds the limit, replace the upper crankcase.



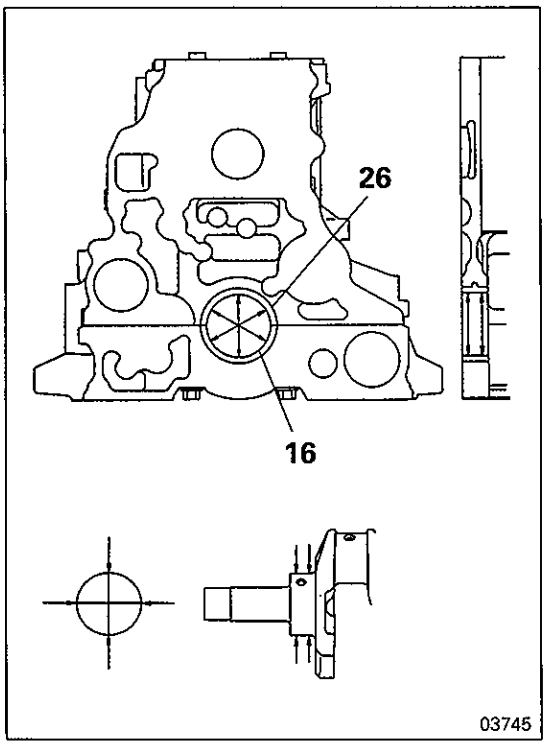
MAIN BEARING

Caution

- **Be sure not to use the main bearings 16 and 26 expanded forcedly.**
- **When either the main bearing 16 or 26 is defective, replace them in pairs.**

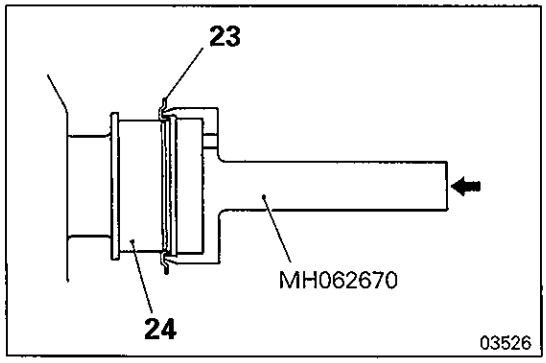
Free Span

(1) Measure the free span of each of the main bearings **16** and **26**. If the reading for either bearing or both exceeds the specified service limit, replace them in pairs.



Main Bearing-to-Crankshaft Clearance

(1) If the reading is less than the specified service limit, replace defective part.



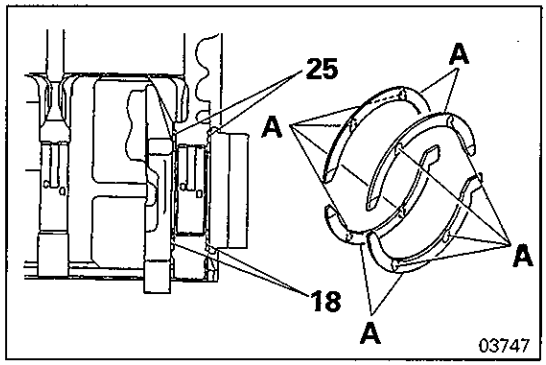
INSTALLATION SERVICE POINTS

▶A◀ REAR OIL SEAL SLINGER INSTALLATION

(1) Drive the rear oil seal slinger **23** onto the crankshaft **24** using the special tool until it completely contacts the rear end of the crankshaft.

◗B◖ CRANKSHAFT GEAR INSTALLATION

(1) Before installing, heat the crankshaft gear **21** to approximately 100°C (212°F) with a piston heater or the like.



◗C◖ THRUST PLATE INSTALLATION

(1) Install the thrust plates **18** and **25** to the crankshaft assembly **19** at No.5 journal only.

Caution

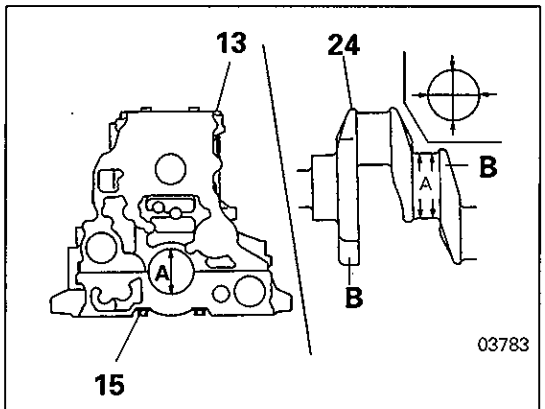
- **Install the thrust plates 18 and 25 with the oil groove A oriented out00ward.**
- **If the oversize thrust plates are to be used, be sure to use the same size of upper thrust plate 25 and lower thrust plate 18 at one side. However, using the same size of upper (or lower) thrust bearings on both sides is not necessary.**

◗D◖ MAIN BEARING INSTALLATION

(1) The main bearings **16** and **25** must have a proper plate thickness that matches the difference between the bearing mounting hole I.D. of the crankcase assembly **13** and the journal O.D. of the crankshaft **24**.

(a) Measure the bearing mounting hole I.D. of the crankcase assembly **13** and the journal O.D. of the crankshaft **24**.

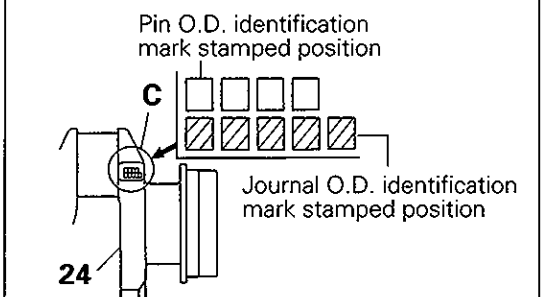
A: Measuring point (One point in vertical direction for crankcase)



Caution

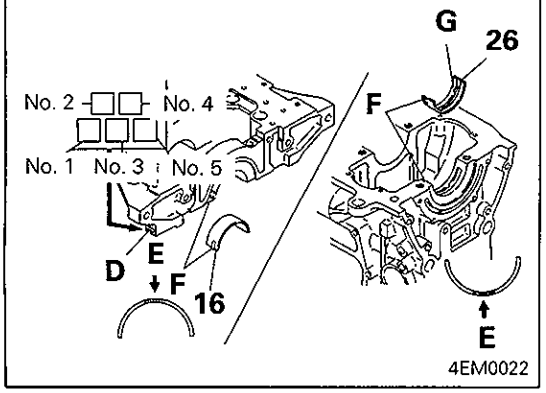
- **Tighten the main bearing cap bolts 15 by specified procedure before measuring the bearing mounting hole I.D. of the crankcase assembly 13. (Refer to 11A-28-1.)**
- **For the service parts, the above dimensions can be identified by the identification colors or identification marks on the crankcase and crankshaft.**

B: Identification color position
C: Identification mark position
D: Identification mark position (rear right of the crankcase)



(b) Select an appropriate thickness of the main bearings **16** and **26** from the following table.

E: Identification color position (side)
F: Lug
G: Oil hole



Caution

- **The main bearing 16 and 26 must be installed in the specified direction.**
  The main bearings for No. 3 journal are different in thickness from the others.
- **The upper main bearing 26 for No. 3 journal is different in shape from the others.**

Unit: mm (in.)

Crankshaft		Crankcase		Main bearing			
Identification color (Identification mark)	Journal O.D.	Size mark	Bearing mounting hole I.D.	Identification color (L/U)	Journal No.	Plate Thickness	Oil Clearance
None (1)	68 (2.68) –0.022 (–0.0009) –0.030 (–0.0012)	A	72 (2.83) +0.019 (0.0007) +0.010 (0.0004)	Black/ Black	No. 1,2,4,5	2 (0.08) –0.004 (–0.0002) –0.008 (–0.0003)	0.040 – 0.065 (0.0016 – 0.0026)
					No. 3	2 (0.08) –0.014 (–0.0006) –0.018 (–0.0007)	0.060 – 0.085 (0.0024 – 0.0033)
		B	72 (2.83) +0.010 (+0.0004) +0 (+0)	Blue/Blue	No. 1,2,4,5	2 (0.08) –0.008 (–0.0003) –0.012 (–0.0005)	0.038 – 0.064 (0.0015 – 0.0025)
					No. 3	2 (0.08) –0.018 (–0.007) –0.022 (–0.009)	0.058 – 0.084 (0.0023 – 0.0033)
Blue (2)	68 (2.68) –0.030 (–0.0012) –0.039 (–0.0015)	A	72 (2.83) +0.019 (0.0007) +0.010 (0.0004)	Yellow/ Yellow	No. 1,2,4,5	2 (0.08) –0 (–0) –0.004 (–0.0002)	0.040 – 0.066 (0.0016 – 0.0026)
					No. 3	2 (0.08) –0.010 (–0.0004) –0.014 (–0.0006)	0.060 – 0.086 (0.0024 – 0.0034)
		B	72 (2.83) +0.010 (+0.0004) +0 (+0)	Black/ Black	No. 1,2,4,5	2 (0.08) –0.004 (–0.0002) –0.008 (–0.0003)	0.038 – 0.065 (0.0015 – 0.0026)
					No. 3	2 (0.08) –0.014 (–0.006) –0.018 (–0.007)	0.058 – 0.085 (0.0023 – 0.0033)

L: Lower main bearing U: Upper main bearing

◆E◆ LOWER CRANKCASE INSTALLATION

(1) Apply an even bead of sealant **A** to the illustrated position of the upper crankcase **28**. [Bead diameter: 2 ± 1 mm (0.08 ± 0.04 in.)]

(2) Install the lower crankcase **17** to the upper crankcase **28** within 15 minutes after the application of sealant **A**.

Caution

- **Be sure that the surface to be coated with sealant A is clean and free of slush and other foreign matters.**
- **When installing the lower crankcase, be sure that sealant A does not smear the surroundings.**
- **After the lower crankcase is installed, wait for at least one hour before starting the engine.**
- **Remove and reinstall the lower crankcase with fresh bead of sealant A whenever the main bearing cap bolts 15 were loosened or removed after the installation.**

(3) After installing the lower crankcase **17**, verify the following:
Smooth rotation of the crankshaft assembly **19**
End play of the crankshaft assembly **19** within specified service limit (See page 11A-28-5.)