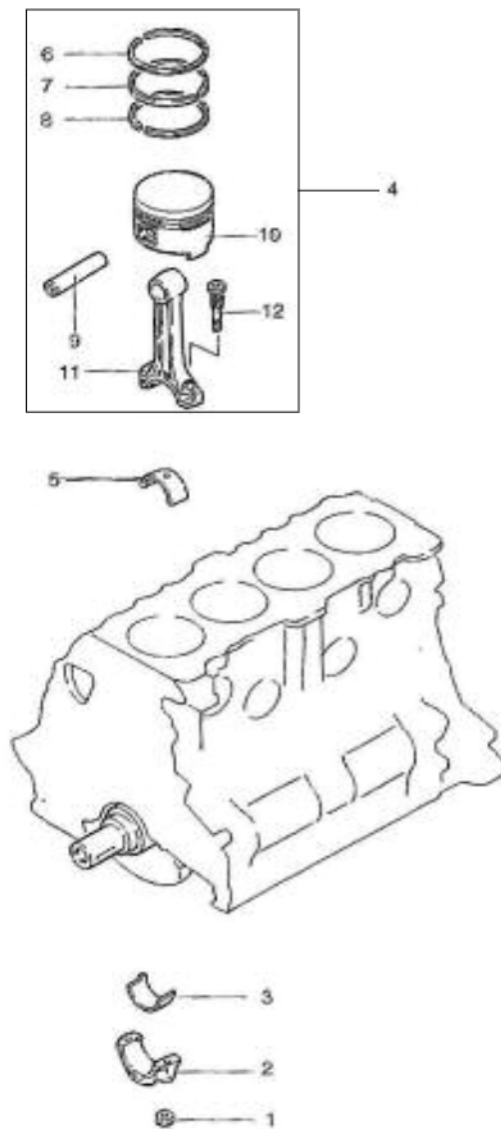


Chapter 4 Crank Connecting Rod Mechanism

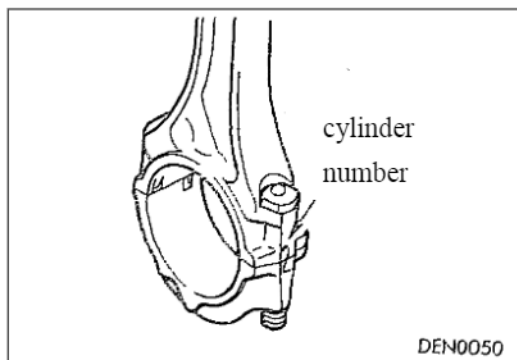
1、Piston and connecting rod component

Daub oil on all the inner parts when installing.

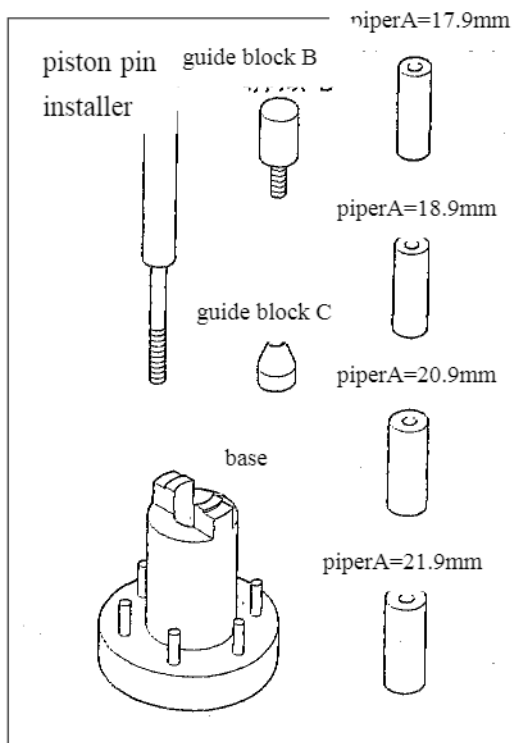


Disassembling steps

1. Connecting rod nut 2. Connecting rod cap 3. Connecting rod bearing
4. Piston and connecting rod component
5. Connecting rod bearing 6. No.1 compression ring 7. No.2 compression ring
8. Oil control ring
9. Piston pin 10. Piston 11. Connecting rod 12. Connecting rod bolt



- (1) Mark cylinder number on the side of connecting rod big end to prepare for correct installation.
- (2) Take turns putting connecting rod, connecting rod cap and connecting rod bearing away, according to cylinder number.

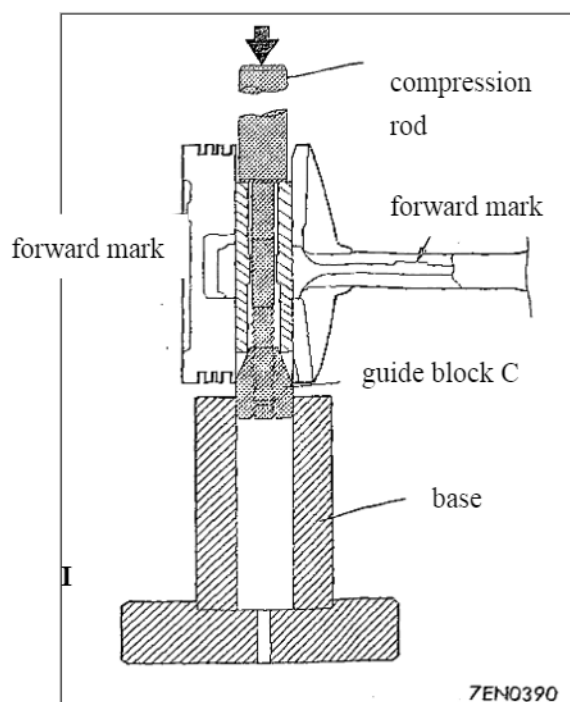


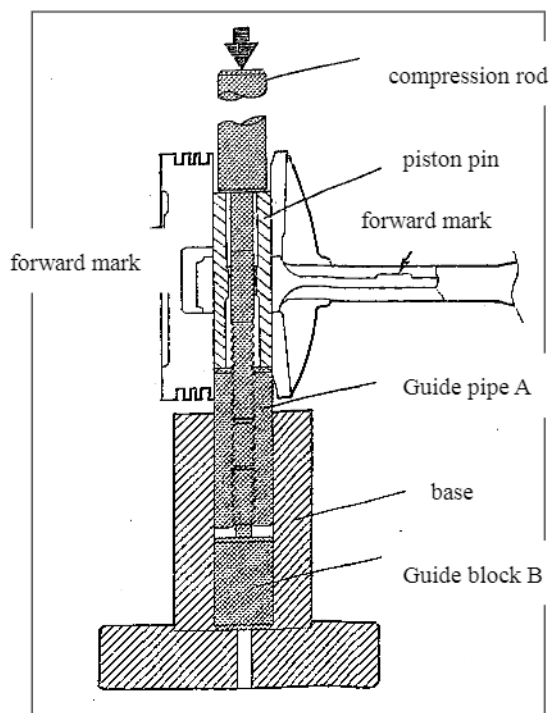
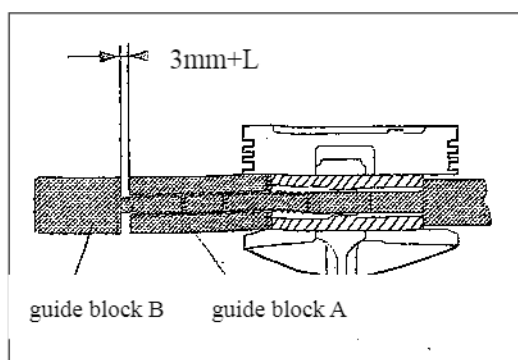
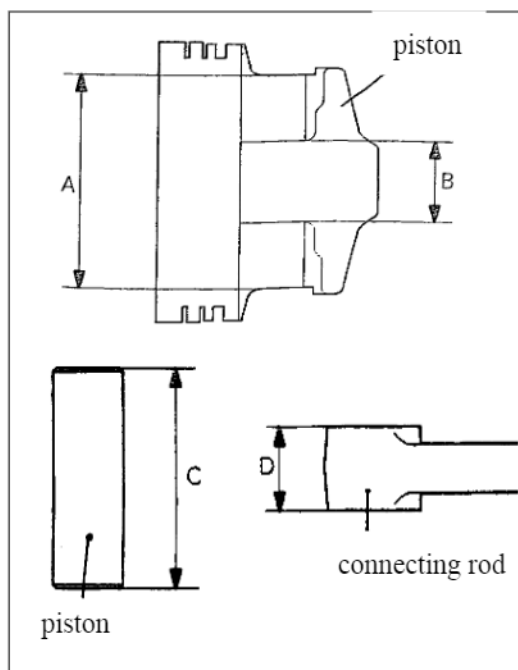
Piston Pin Disassemble

- (1) After inserting compression rod of the special tool from the top of piston marked with the arrowhead, install guide block C in the top of compression rod.
- (2) Keep forward mark of piston upward. Install piston and connecting rod component in base of piston pin installer (special tool).
- (3) Force piston pin out with pressure.

Caution:

Take turns putting piston, piston pin and connecting rod disassembled away according to cylinder number.





Installation Notice

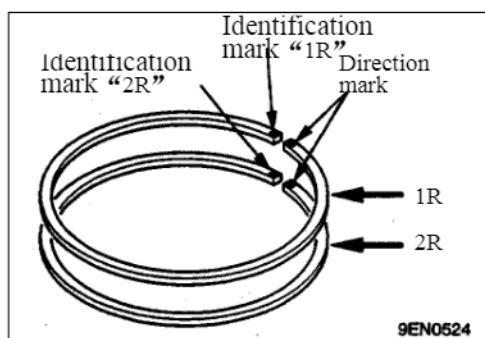
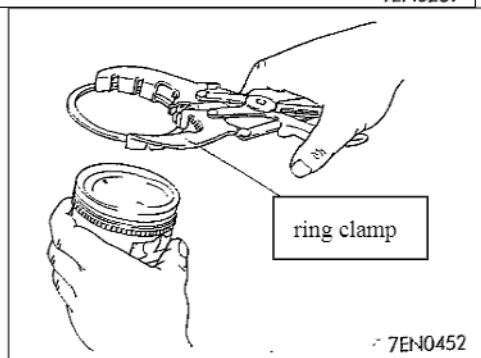
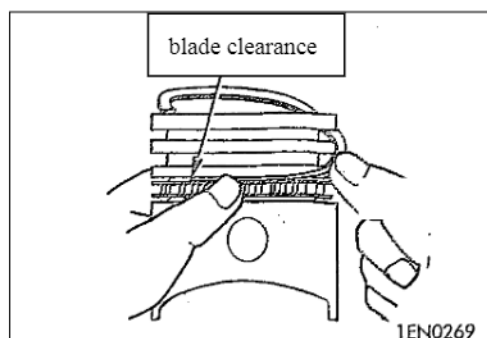
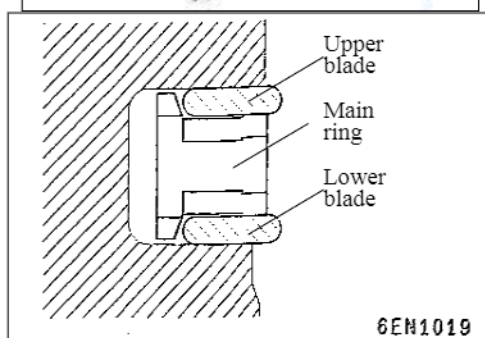
Piston Pin Installation

- (1) Measure the following sizes of piston, piston pin and connecting rod.
 A: Length of inserting piston pin in the hole.
 B: Width of pin sockets
 C: Length of piston pin
 D: Width of small end of connecting rod.
- (2) Put measured sizes above into following formula to calculate L.

$$L = [(A - C) - (B - D)] / 2$$
- (3) After inserting compression rod of the special tool into piston pin, install pipe A in the top of compression rod.
- (4) Install forward marks of piston and connecting rod towards the same direction.
- (5) Daub engine oil on the external diameter of piston pin
- (6) Through Pipe A, insert compression rod, piston pin and pipe component installed according to (3) into piston pin hole from the side of forward mark.
- (7) Screw on guide block B into guide pipe A to make clearance value between guide block A and guide block B equal to the value of Value L got from (3) plus 3mm.
- (8) Keep forward mark of piston upward. Install piston and connecting rod component in base of piston pin installer.
- (9) Force piston Pin in under pressure. When the pressure is less than standard value, replace piston pin and piston component and/or replace connecting rod.

standard value: 7350~17200N

freely.



Oil Control Ring Installation

- (1) Put the main ring of oil control ring into oil ring groove.

Remarks:

1. There's no difference of upper and lower surface between blade and main ring.
2. New blade and new main ring shall be colorized to distinguish their sizes.

Size	Identification color
Standard	Nil
Increase 0.50mm	Red
Increase 1.00mm	Yellow

- (2) Put upper blade. When installing blade, force one side of blade into piston oil ring groove. Then force the rest parts of blade into oil ring groove with the thumb as shown. Expanding blade with ring clamp will break it off and make it differed from other piston rings.

Caution:

Don't use ring clamp to install blade

- (3) Install lower blade in accordance with Step (2).
- (4) Ensure if blade can turn from the left to the right freely after installing blade.

Installation of No.1 compression ring and No.2 compression ring

- (1) After installing No.2 compression ring, install No.1 compression ring with ring clamp.

Remarks:

1. There's the identification mark on the top of the ring.

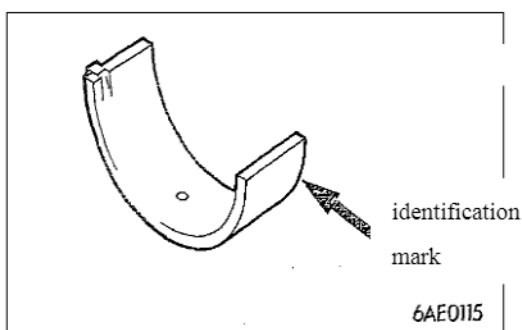
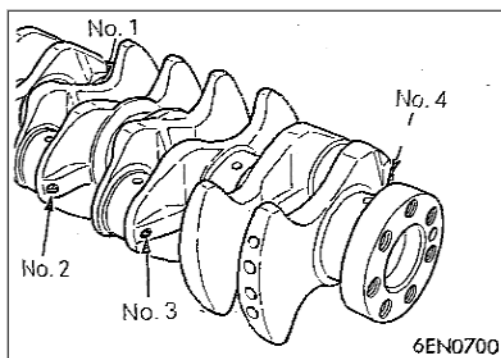
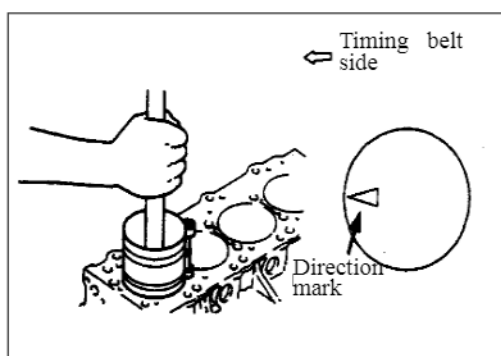
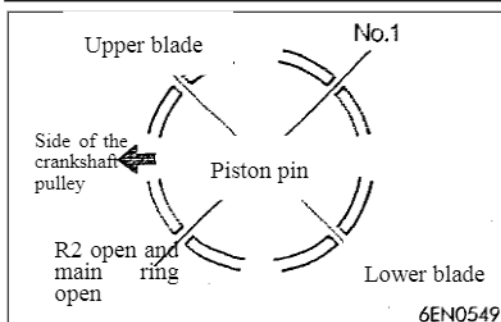
Identification mark

No.1 ring.....1R

No.2 ring.....2R

2. When installing piston ring, keep the mark upwards and towards the top of piston.
3. Size marks of piston shown as the following.

Size	Size mark
Standard	Nil
Increase 0.50mm	50
Increase 1.00mm	100



Piston and Connecting Rod Component Installation

- (1) Daub enough engine oil on piston, compression ring and oil control ring.
- (2) Adjust open position of compression ring and oil control ring (blade and main ring) to the position as shown.
- (3) Rotate crankshaft to make crank pin located in the middle of cylinder
- (4) Before inserting piston and connecting rod component into cylinder, proper screw-mounted protector is applied in connecting rod bolt. Be careful and don't damage crank pin.
- (5) Use suitable piston ring compressor to insert piston and connecting rod component into cylinder.

Caution:

- There's a forward mark on the top of piston, make it point to straight position of the engine (the side of timing belt).

Connecting Rod Bearing Installation

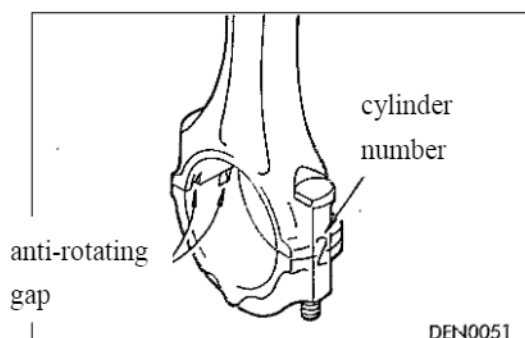
If it is necessary to replace bearing, choose and install bearing according to the following steps.

- (1) Measure external diameter of crank pin and confirm the groups according to the following table. As crankshaft for maintenance, distinguish sizes by painting color in the position as shown.
- (2) Identification mark of connecting rod bearing is imprinted in the position as shown.

Groups	Crank pin		Connecting rod bearing		
	Identification color	External diameter (mm)	Identification mark	Identification color	Thickness (mm)
I	Yellow	44.995~45.000	1	Yellow	1.487~1.491
II	Nil	44.985~44.995	2	Nil	1.491~1.495
III	White	44.980~44.985	3	Blue	1.495~1.499

Internal diameter of connecting rod: 48.000~48.015mm

- (3) Choose bearing in the table above, according to groups assured in (1) and (2).
Examples for choosing bearing:
If measurement value of external diameter of crankshaft pin is 44.996mm, it shall be Group 1 in the table above. If replacing crankshaft of maintenance, check identification color applied on new crankshaft pin. If it's yellow, crankshaft pin shall be Group 1 and choose connecting rod bearing of which identification mark is 1.



Installation of Connecting Rod Cap

(1) When installing connecting rod cap, check marks of disassembling. If installing new parts which have no marks, install anti-rotating gap as shown on one side.

(2) Ensure if axial clearance of big end of connecting rod is suitable.

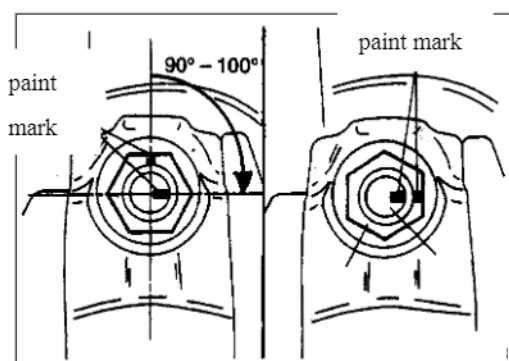
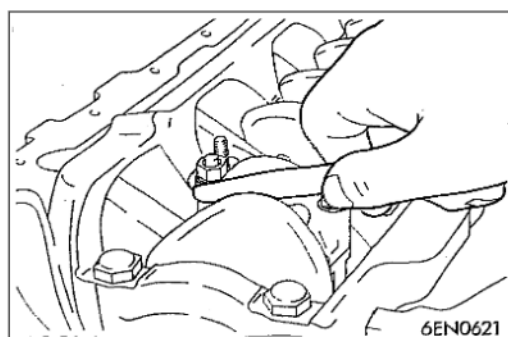
Standard value: 0.10~0.25mm

Limit value: 0.4mm

Connecting Rod Nut Installation

Caution:

- Before installing connecting rod cap, disassemble spark plug and install connecting rod nut, if having installed cylinder cap.



(1) As for connecting rod nut and bearing, plastic-zone screw-on method shall be adopted. Before reusing the bearing, check if the bearing is expanded. Checking method: screw nuts into screw thread of bearing with fingers till the whole length of screw thread. If nuts can't be screwed on smoothly, screw thread may be expanded and bearing should be replaced.

(2) Before screwing nuts on, daub oil on screw thread of nuts and seat surface.

(3) Screw nuts into bearing with fingers and screw nuts on alternatively to install connecting rod cap correctly.

(4) Screw nuts on by torque of 20N. M.

(5) Daub paint mark on every nut head.

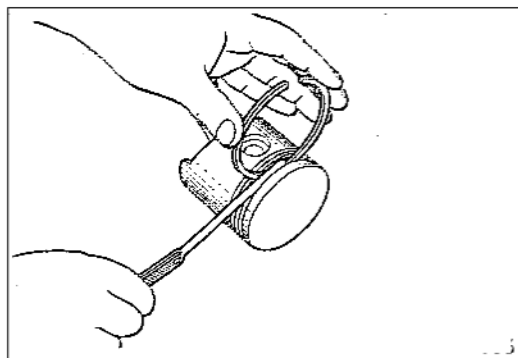
(6) Daub paint mark on bolts of which the position is from paint mark on every nut head to screwing direction of 90~100° and note down the paint mark.

(7) Screw nuts on from 90~100° until marks on nuts and bearing are aligned.

Caution:

- If screwing angle is less than 90° , screwing specified capability can't be assured. When screwing it on, notice screwing angle.

- If screwing nuts are excessively tightened (exceed angle of 100°) , screw nuts off totally. And restart to screw nuts from step 1



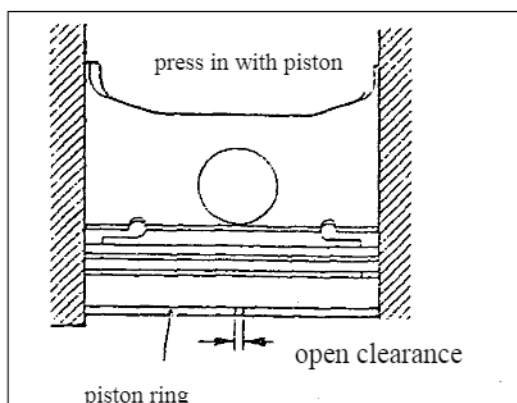
Check

Piston ring

- (1) Check if there's damage, excessive wear and breach on piston ring. If any, replace it. If replacing piston, it is necessary to replace piston ring.
- (2) Check clearance between piston ring and piston ring groove. If it's too wide, replace piston ring or both of them.

Standard value: 0.02~0.06mm

Limit value: 0.1mm



- (3) Put piston ring into cylinder. After using top surface of piston to put it away, measure open clearance with clearance gauge. When open clearance is too wide, replace piston ring.

Standard value:

No.1 ring...0.25~0.35mm

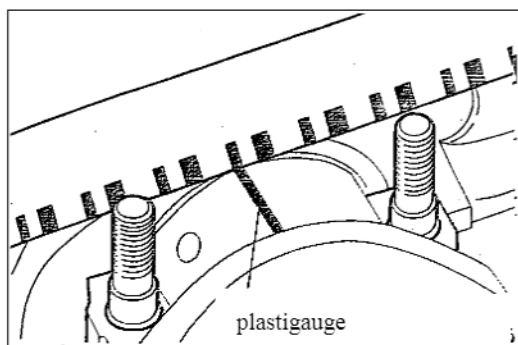
No.2 ring...0.40~0.55mm

Oil control ring...0.10~0.40mm

Limit value:

No.1 ring and No.1 ring...0.8mm

Oil control ring...1.0mm

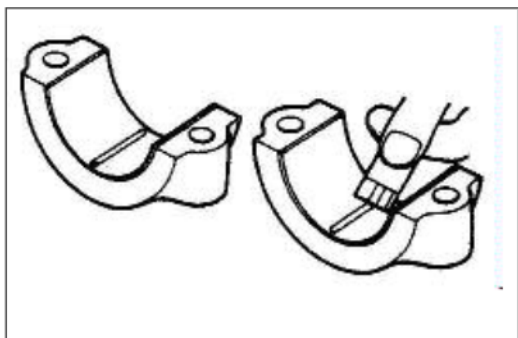


Oil clearance of crank pin (Plastigauge)

- (1) Clean the oil on connecting rod neck and bearing out.
- (2) Divide plastigauge into the same length of rearing width and put it on crank pin and make it parallel to axle center line.
- (3) Install connecting rod cap carefully, and screw nuts on according to the regulated torque.
- (4) Disassemble connecting rod cap carefully.
- (5) Use measuring rule imprinted on the package of plastigauge to measure the width of the widest part of staved plastic line and get clearance value.

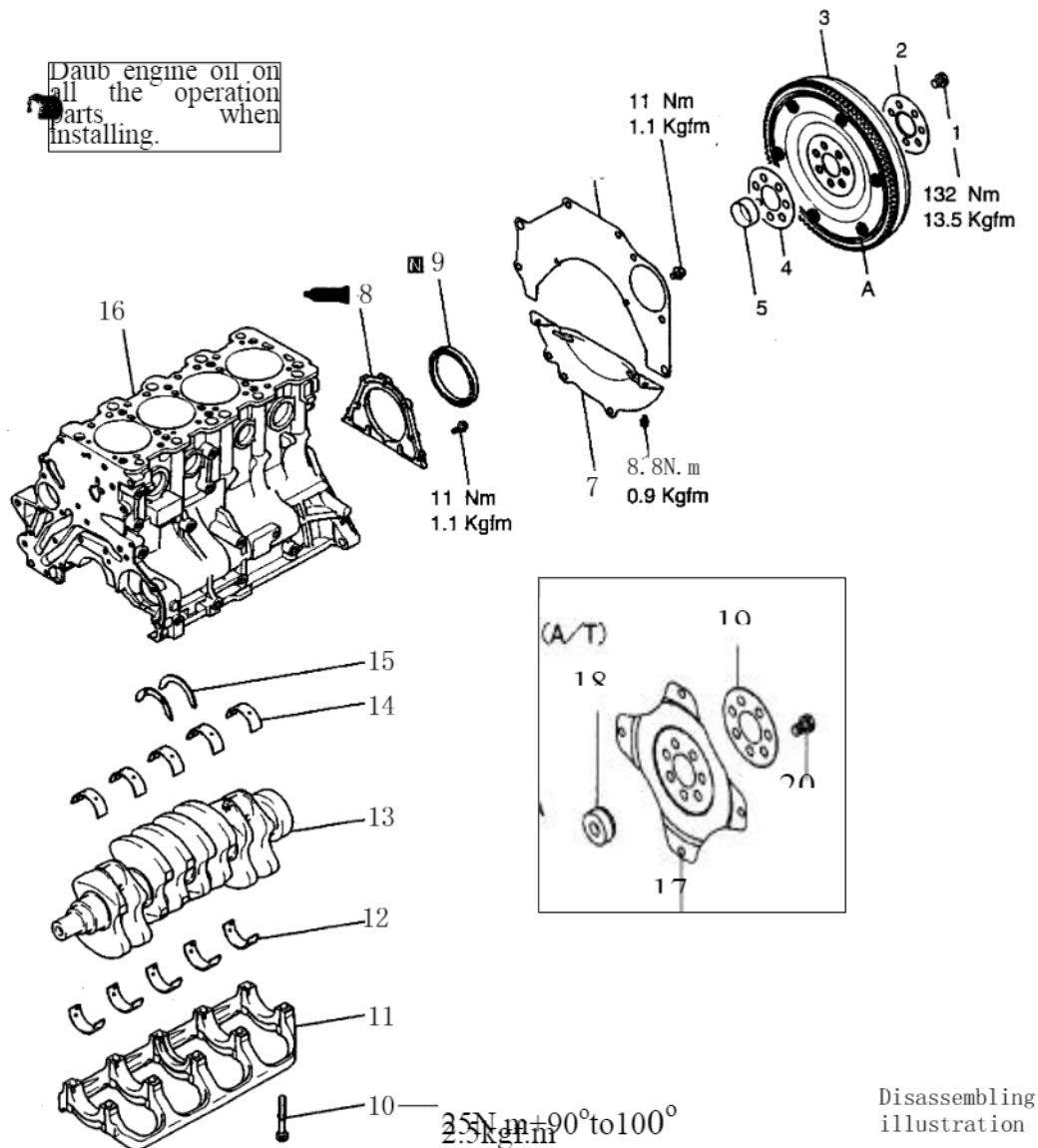
Standard value: 0.02~0.05mm

Limit value: 0.1mm



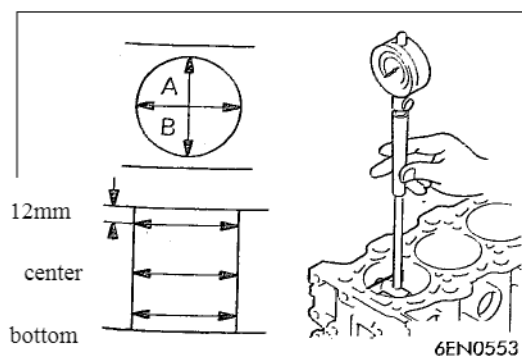
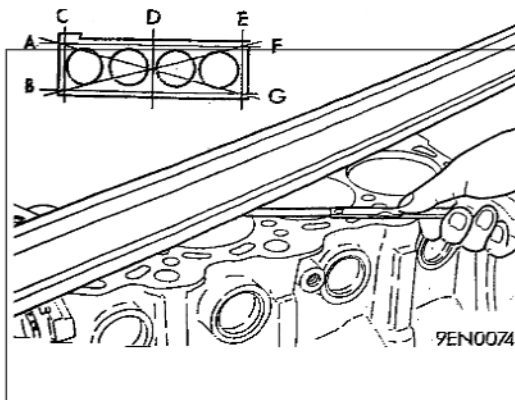
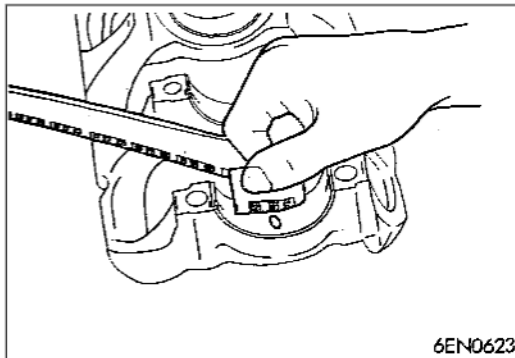
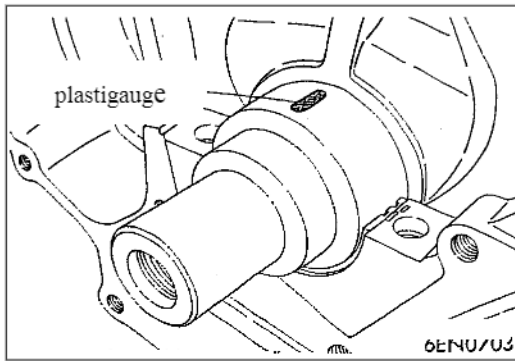
2 、 Crankshaft, cylinder block and flywheel

Daub engine oil on all the parts when installing.



Disassembling steps

1. Screw rearing of flywheel<M/T>
2. Jointing board<M/T>
3. Flexible flywheel<M/T>
4. Jointing board<M/T>
5. Crankshaft bushing<M/T>
6. Rear cover board
7. Bell housing
8. Rear oil seal cap
9. Rear oil seal
10. Main bearing cap bolt
11. Main bearing cap
12. Lower bearing of crankshaft
13. Crankshaft
14. Upper bearing of crankshaft
15. Crankshaft thrust rearing
16. Cylinder block
17. Drive board <A/T>
18. Crankshaft sleeve <A/T>
18. Jointing board <A/T>
19. Driving board bolt <A/T>



Oil clearance of crankshaft (Plastigauge)

- (1) Clean the oil on main journal and internal diameter of bearing out.
- (2) Install crankshaft.
- (3) Divide plastigauge into the same length of bearing width and put it on crankshaft journal and make it parallel to axle center line.
- (4) Install main bearing cap carefully, and screw nuts on according to the regulated torque.
- (5) Disassemble main bearing cap carefully.
- (6) Use measuring rule imprinted on the package of plastigauge to measure the width of the widest part of staved plastic line and get clearance value.

Standard value: 0.02~0.04mm

Limit value: 0.1mm

Cylinder block

- (1) Observe if there are defects like scratch, rust and corrosion with eyes. Use defect detector to check breach. If any, fix or replace it.
- (2) Check if the surface of cylinder block warps and assure there's no pad scraps or other foreign matters.

Standard value: 0.05mm

Limit value: 0.1mm

- (3) If warping excessively, revise or replace it within the permitting range.

Abrasive limit: 0.2mm

Maximum sum of abrasive thickness of cylinder block and cylinder cap permitted is 0.2mm.

Height of cylinder block(new):

4G63 284mm, 4G64 290mm

- (4) Check if there's scratch and cylinder sticking. If it's disqualified, revise (increase the size) or replace it.
- (5) Check internal diameter of cylinder and cylindricity with cylinder bore gauge.

Revise cylinder according to increased diameter, replace piston and piston ring if wearing badly. Checking position as shown.

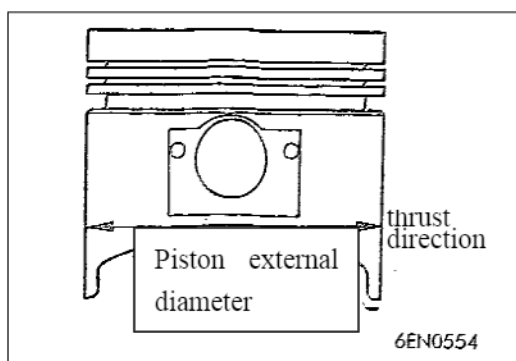
Standard value:

internal diameter of cylinder

4G63 85.00~85.03mm

4G64 86.50~86.53mm

Cylindricity: $\leq 0.01\text{mm}$



Cylinder reboring

(1). Choose diameter of piston increased according to the maximum cylinder bore.

Identification of piston sizes

Size	Identification mark
Increase 0.50	0.50
Increase 1.00	1.00

Note: Imprint size marks on the top of piston

(1). External diameter of piston used in the measurement should be measured in the thrust direction as shown.

(2). According to measuring value of external diameter of piston, calculate the size of cylinder reboring.

size of cylinder reboring = external diameter of piston + (clearance between piston and cylinder) - 0.02mm (Abrasive capacity)

(1) Rebore every cylinder bore to size of cylinder reboring

Notice: When boring out cylinder, process according to the following procedures to avoid errors because of temperature raising :No. 2→No. 4→No. 1→No. 3

(2) Cylinder bore which is abrasive to the ultimate. (diameter of piston + clearance between piston and cylinder)

(3) Check clearance between piston and cylinder

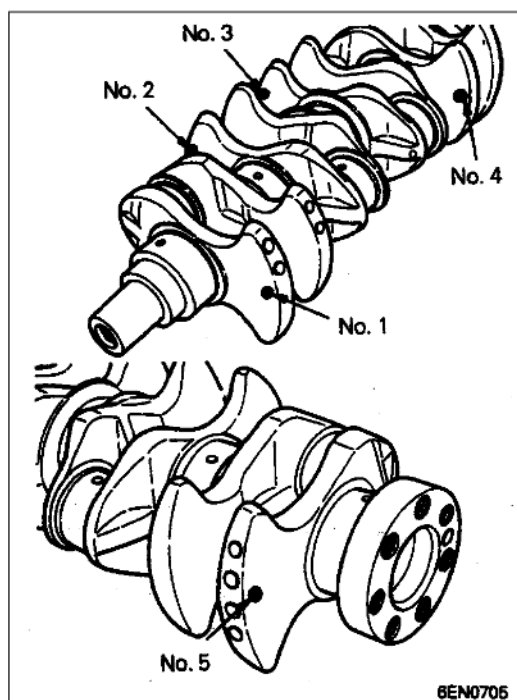
Standard value: 0.02~0.04mm

Remarks: When boring out cylinder, four cylinders should be bored in the same size which is increased, instead of only bore one cylinder.

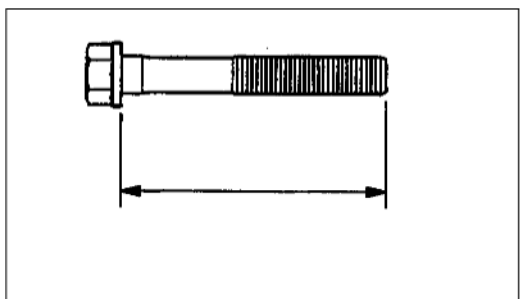
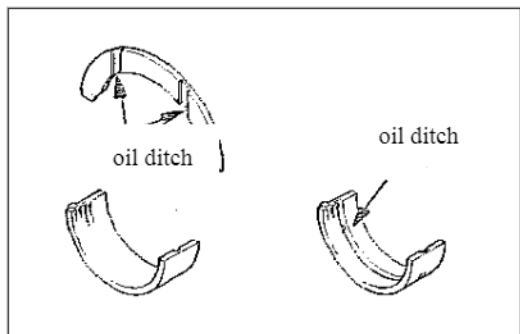
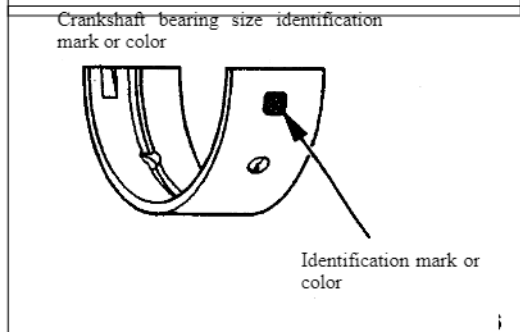
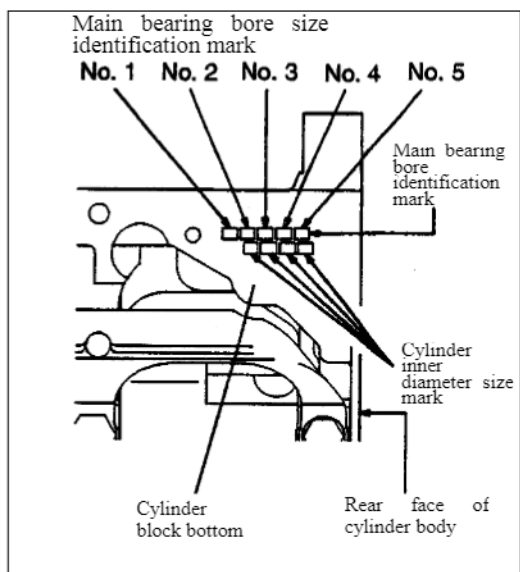
Installation notice

Installation of crankshaft bearing

(1) Choose bearings that conform to crankshaft main journal according to the following table.



Combination of crankshaft main journal and spindle bore			Identification mark and color of No. 1, 2, 4, 5 journal bearing	Identification mark and color of No. 3 journal bearing
Groups	Identification on color	External diameter (mm)		
I	Yellow	56.994—57.000	0	1、green
			1	2、yellow
			2	3、nil
II	Nil	56.988—56.994	0	2、yellow
			1	3、nil
			2	4、blue
III	White	56.982—56.988	0	3、nil
			1	4、blue
			2	5、red



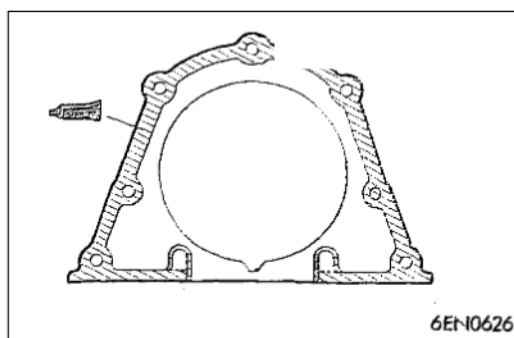
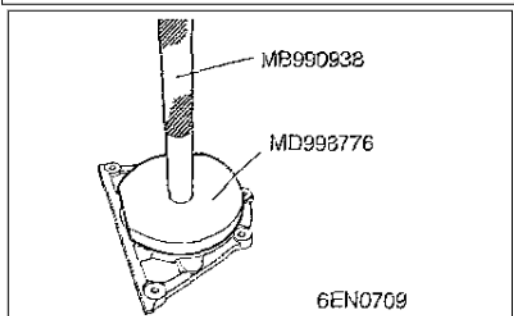
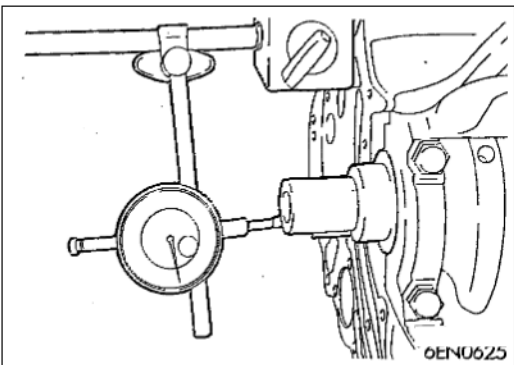
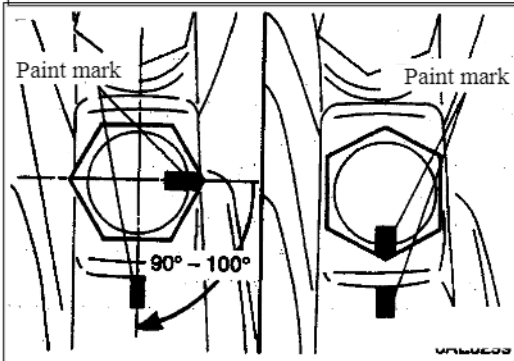
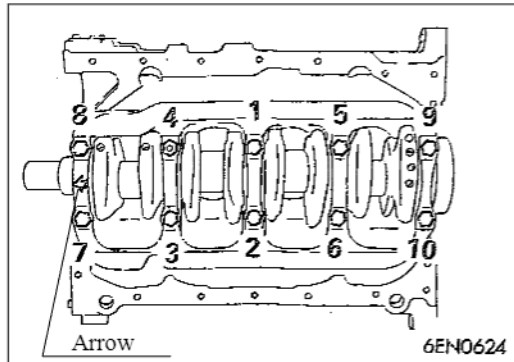
Examples for bearings choosing

- If identification color of crankshaft main journal is yellow and identification mark of spindle bore is "1", choose the No. 1,2,4,5 bearing of which identification mark is "2" and identification color is "yellow" and No.3 bearing of which identification mark is "1" and identification color is "green".
- If there's no identification paint color on crankshaft, measure main journal and choose corresponding groups of bearing according to measurement value.

- (2) Install bearing with grooves on one side of cylinder block.
- (3) Install bearing without grooves on one side of main bearing cap.
- (4) Install two of thrust bearing of crankshaft in No. 3 main bearing hole of cylinder block. For convenient installation, apply a little oil on the surface of thrust bearing.
- (5) One side of thrust bearing with groove should face towards crankshaft crank arm.

Main bearing cap and main bearing cap bolt installation

- (1) Install arrowhead of main bearing cap towards the side of timing belt.
- (2) Before screwing main bearing cap bolt on, assure that length of bolts is less than value limit. If not, replace the bolt.
Limit value (A): 71.1mm
- (3) Daub oil on screw thread of nuts and seat surface.
- (4) Screw main bearing cap bolt on by torque of 25N.M, according to regulated order.



- (5) Daub paint mark on every nut head.
- (6) Daub paint mark on the main bearing cap of which the position is from paint mark on bolts to screwing direction of $90^{\circ} \sim 100^{\circ}$
- (7) Screw nuts on from $90^{\circ} \sim 100^{\circ}$ regulated in the picture above, according to screwing order till paint mark on bolts aligns paint mark on main bearing cap.

Notice:

- If screwing angle is less than 90° , screwing specified capability can't be assured. When screwing it on, pay much attention to screwing angle.
- If screwing nuts are excessively tightened (exceed angle of 100°), screw nuts off totally. And restart to screw nuts from Step 1.

- (8) After installing main bearing cap, assure if crankshaft can turn smoothly and check axial clearance. If axial clearance exceeds usage limit value, replace NO.3 crankshaft thrust bearing of crankshaft.

Standard value: 0.05~0.18mm

Limit value: 0.25mm

Oil seal installation

Rear oil seal cap installation

Specified sealant:

Brand: Mitsubishi pure components
MD970389 or corresponding equivalents.

Notices:

- (1) Ensure rear oil seal cap is installed quickly when sealant is still wet. (≤ 15 min)
- (2) After installing, keep sealed area away from lubricate grease and coolant for one hour.