

SQR 472 Engine

(Service Manual for Mechanical Part)

After-sales Department of Chery Automobile Sales Co., Ltd.

CONTENTS

Chapter 1 Reading Instruction	2
1) Reading method of Maintenance Instruction.....	2
2) Meaning of Marks and Abbreviations	3
3) Special Maintenance Tool.....	4
Chapter 2 Disassembly, Assembly and Maintenance.....	6
1) Timing Belt.....	6
1. Structure Diagram.....	6
2. Disassembly	7
3. Installation	10
2) Camshaft.....	13
1. Structure Diagram.....	13
2. Disassembly	14
3. Installation	16
4. Routine Inspection of Valve.....	19
3) Cylinder Head.....	22
1. Structure Diagram.....	22
2. Disassembly	23
3. Routine Inspection	23
4) Water Pump	29
1. Structure Diagram.....	29
2. Disassembly	29
3. Cleanup.....	29
4. Routine Inspection	29
5. Assembly.....	29
5) Oil Pump.....	29
1. Structure Diagram.....	30
2. Disassembly	30
3. Cleanup.....	30
4. Disassembly and Assembly of Engine Oil Pump.....	43
4.1 Structure Diagram.....	42
4.2 Disassembly	42
4.3 Routine Inspection	42
4.4 Installation.....	44
5. Disassembly of Oil Seal.....	45
5.1 Structure Diagram.....	45
5.2 Disassembly	46
5.3 Inspection.....	46
5.4 Assembly of Oil Seal	46
6 Assembly.....	46
6) Crank Connecting Rod Mechanism.....	46
1. Structure Diagram.....	48
2. Disassembly of Crank Connecting Rod mechanism.....	48
3. Cleanup.....	49
4. Routine Inspection	52
5. Assembly of Crank Connecting Rod Mechanism	53



Chapter 3 Table of Main Fit Clearance for SQR472 Engine 55

Chapter 4 Table of Measurement Parameters of SQR472 Engine 59

Chapter 5 Table of Main Fitting Torque for SQR472 Engine 61

Chapter 6 Positions on SQR472 Engine to be Lubricated 62

Chapter 7 Positions on SQR472 Engine to be Spread with Sealant..... 65

Chapter 1. Reading Instruction

1) Reading Method of Maintenance Instruction

1.1 Auxiliary Materials

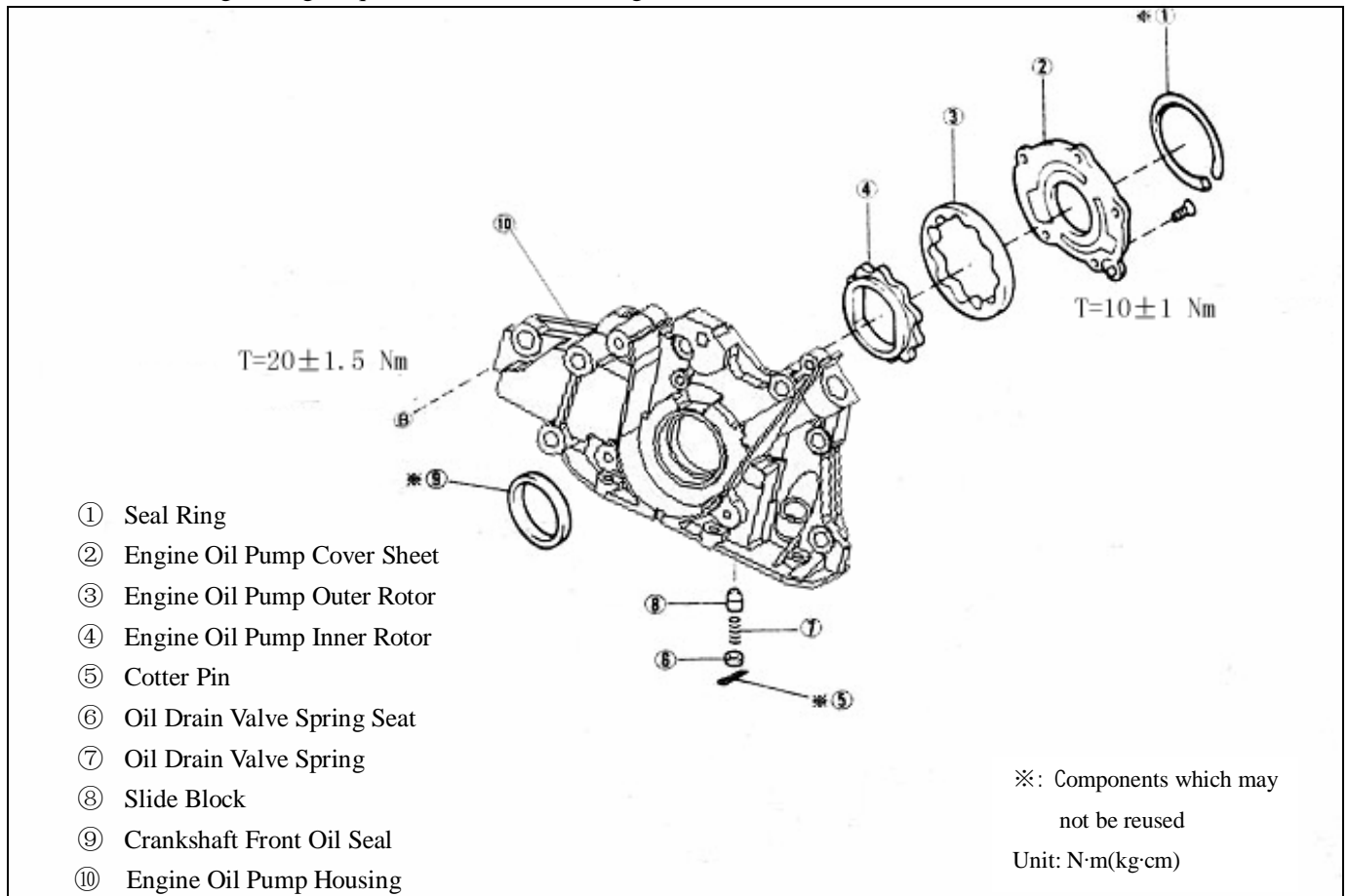
If it is required in the operation instruction to prepare the auxiliary materials such as special tools, tools, measuring instruments and grease in advance, you should list all auxiliary materials required in a table before carrying out each operation.

Since the ordinary tools, lifter and spare parts are conventional materials used in the maintenance, they are omitted here.

1.2 Operating Sequence and Structure Diagram

(1) The diagram of structure and components, name of components and installation status are set forth at the beginning of each chapter or section.

(2) The number in the figure refers to the disassembly sequence of each component. The components which may not be reused and the tightening torque are indicated in the figure.



1.3 Content Omitted in this Manual

The following operating procedures have been omitted in this Manual, and they should be carried out in the actual operation:

- (1) Operation relating to the lifter and the small-sized elevator;
- (2) Cleaning and wiping of common components;
- (3) Relevant visual inspection.

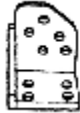




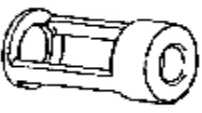


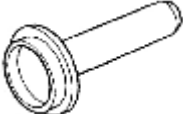

1.4 Definitions

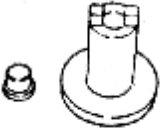


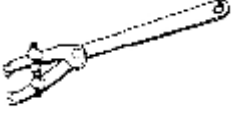


Standard value	Refers to allowed value during inspection, maintenance and adjustment.
Limit	Refers to the maximum or minimum value that should not be exceeded during inspection, maintenance and adjustment
Reference	Set the standard value for simple measurement to prevent from its measuring difficulty and inconsistency to facts.
Difference	Refers to the difference between maximum value and minimum value.
Notice	It carries the cases of damaging the vehicle and parts so you should pay attention to the operation description.
Warning	It records the operation descriptions of cases about person accident.

2) Meaning of Marks and Abbreviations

Mark	Original Words	Intepretation
RH	Right Hand	Right Hand
LH	Left Hand	Left Hand
FR	Front	Front
RR	Rear	Rear
IN	Intake	Intake
EX	Exhaust	Exhaust
SAE	Society of Automotive Engineers	Society of Automotive Engineers
API	American Petroleum Institute	American Petroleum Institute
SPECIAL TOOL	Special Tool	Special Tool
T	Torque	Torque
Ay	Assembly	Assembly
S/A	Sub Assembly	Sub Assembly
W/	With	With
M/T	Manual Transmission	Manual Transmission
A/T	Automatic Transmission	Automatic Transmission
T/C	Turbo Charger	Turbo Charger

3) Special Maintenance Tools:

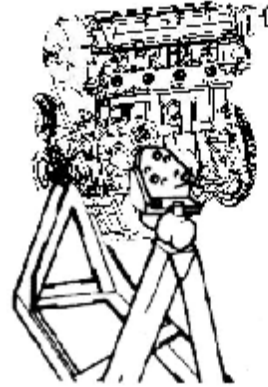
	Outside view	Name or symbol	Purpose
		Engine disassembly and inspection auxiliary device	Mount on the engine service stand
		Engine service stand	Disassembly and assembly of engine
		Clamp hole wrench for camshaft timing gears	Disassembly of camshaft timing gears
		Spring bushing puller	Assembly of camshaft Oil seal
		Valve keeper remove tool	Assembly and disassembly of valve spring retainer lock
		Auxiliary tools	
		Flywheel clamp	Assembly and disassembly of crankshaft gear
		Valve guide punch pin	Disassembly and assembly of Valve guide
		Axial Oil seal replacing device	
		Oil seal base drive	

	Outside view	Name or symbol	Purpose
		Piston pin puller	Disassembly and assembly of piston pin
		Embedded combination oil seal and helical gear puller	Installation of oil seal
		Crankshaft pulley holding tool	Disassembly and assembly of crankshaft pulley
		Wrench	Disassembly and assembly of crankshaft driven gear
			Replace valve clearance adjustment gasket
		Water pump pulley locking wrench	Assembly of coolant pump
Measuring tools	Feeler gauge. Micrometer caliper. Ruler. Dial gauge. Cylinder gauge. Caliber. Pressure gauge. Torque wrench torque wrench		
Tool	Piston ring extractor		
Oil	Engine Oil, adhesive		

Chapter 2. Disassembly, Assembly and Maintenance

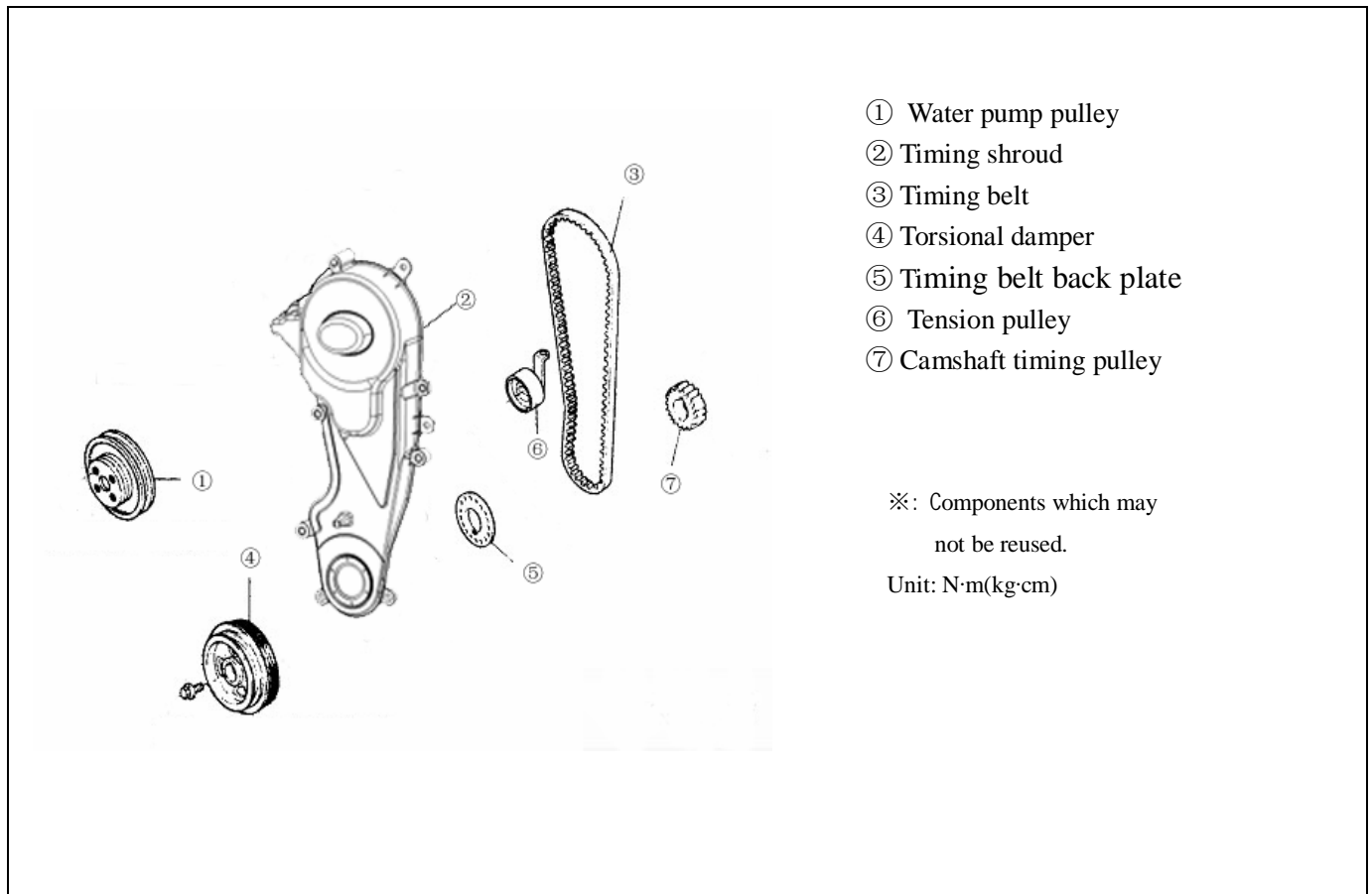
Disassemble or assemble the engine with roll over stand.

Disassemble or assemble the engine parts on the roll over stand.



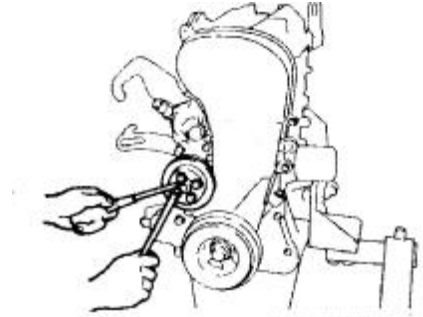
1) Timing Belt

1. Structure Diagram

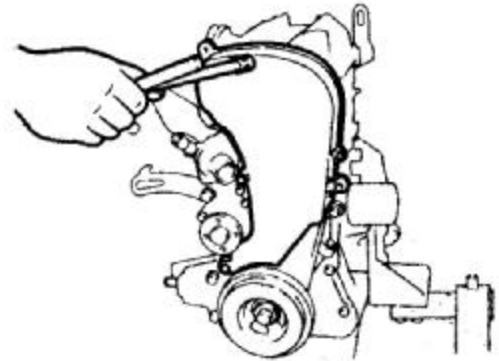


2. Disassembly

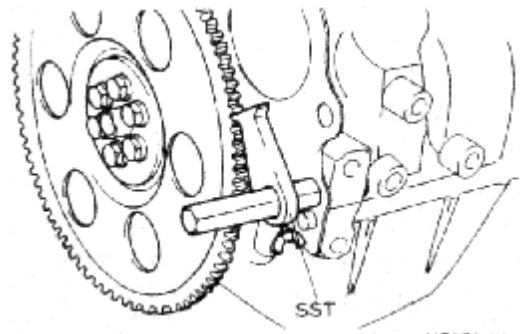
- 2.1 Remove the water pump pulley as the view showing.
It will be better of disassembling with special tool.
Torque: 25 ± 1.5 N.m



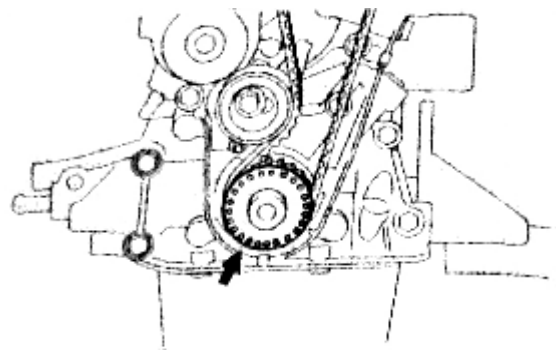
- 2.2 Disassembly of Timing Belt Cover
Torque: 6 ± 1 N.m



- 2.3 Disassembly of torsional damper
Use special tools to prevent the gear ring from rotating. When disassembling the fixing bolts of the torsional damper, make sure that the marks on the crankshaft timing pulley match with the timing marks on the engine oil pump.

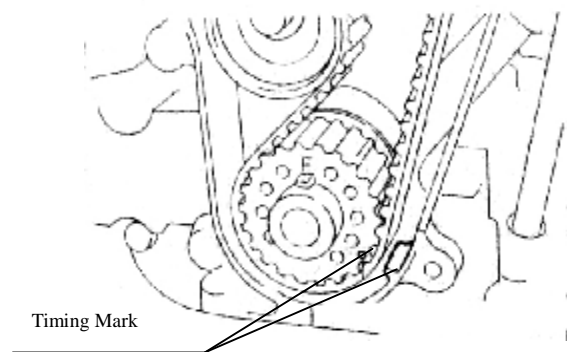
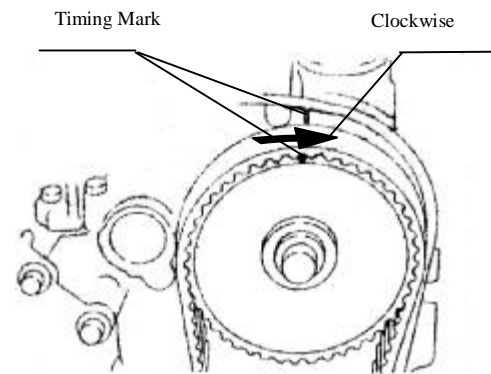


- 2.4 Remove the timing belt back plate.

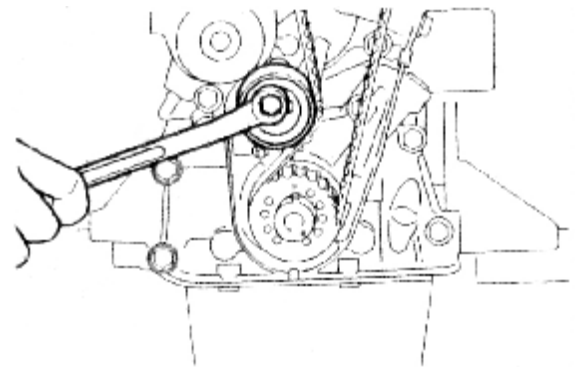


2.5 Disassembly of tension pulley

2.5.1 Compress the top dead center at the first cylinder piston. After disassembly of timing cover, pull the bolt and clockwise rotate the timing gear with wrench. And then align the timing mark of camshaft timing gear and the raised mark on camshaft cover;



2.5.2 Screw off the bolt of tension pulley and remove the tension pulley.

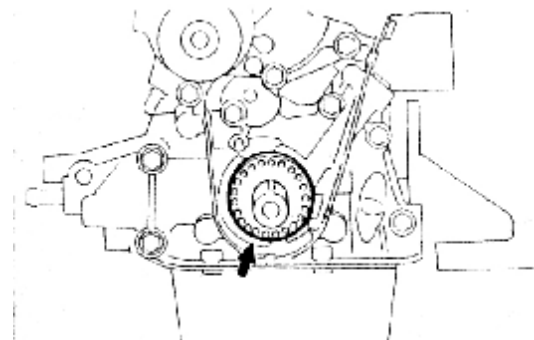


2.6 Disassembly of timing belt

Notice: Do not use sharp tools like screwdriver during disassembly of belt.

Notice: Pay attention to the following items during using the timing belt:

- I Do not bend the belt with small angle, or the rigging in belt will break.
- I Do not pollute grease and water because the using expectancy of belt is short.
- I Only clockwise rotate the engine after mounting the belt.



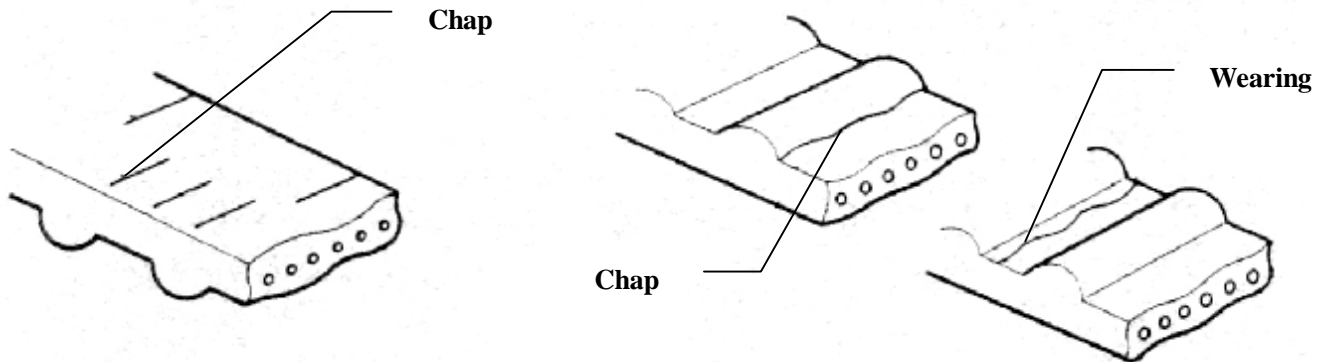
2.7 Disassembly of crankshaft timing gear

2.8 Inspect the timing belt carefully, and replace new components under any of the following circumstances or when the mileage is up to the conditions of replacement:

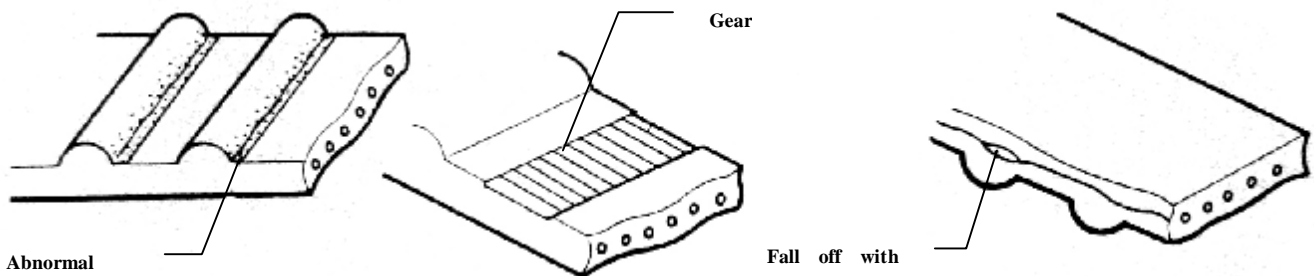
2.8.1 Chap of back-side rubber

2.8.2 Chap of dedendum, chap of separated cord fabric.

2.8.3 Wearing, gear missing and incomplete gear of cord fabric.



2.8.4 Abnormal wearing of belt flank.



2.8.5 Notice: Replace the belt as any following situation occurs, even though abrasion cannot be found directly: The water pump leaks water out, and requires continuing infusion. If the belt is spotted with much oil stains, and the rubber may be damaged due to expansion, you should replace the belt.

Timing belt model and type

Part number	372-1007081
Width of belt	25.3mm

Tension Pulley of Timing Belt Rotate the bolt of tension pulley bracket and hear if it is noisy; check the contacting surface and look if it is damaged. Model and type of tension pulley of timing belt

Part number	372-1007030
Width	27.0 mm
Outer diameter	φ50mm

Check if the out is damaged. Timing belt model and type

Type	E F
Item	G L, Z L, G S, Z S
Camshaft timing pulley diameter(mm)	φ110.7 ^{+0.1} _{-0.2}
Camshaft timing pulley diameter(mm)	φ54.65 ^{+0.7} _{-0.13}

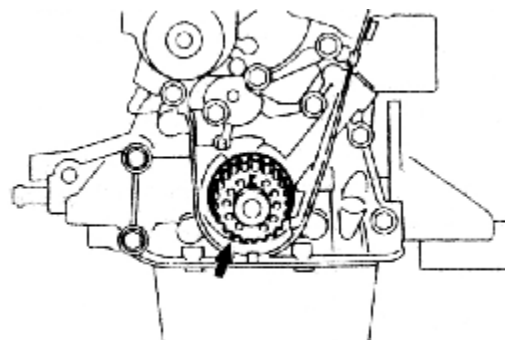
Check the timing belt back plate for any deformation.

Standard size of crankshaft timing gear

Width	28.6mm
-------	--------

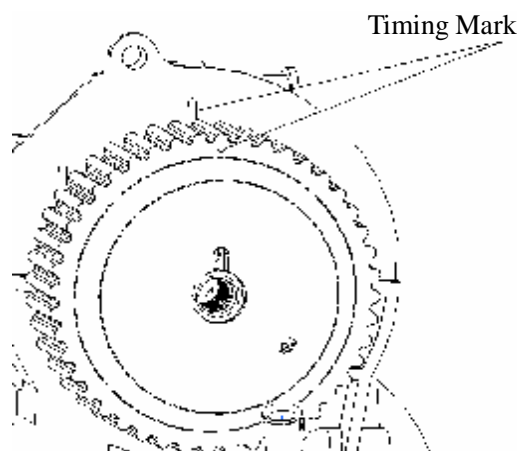
3. Installation

3.1 Assembly of crankshaft timing pulley.

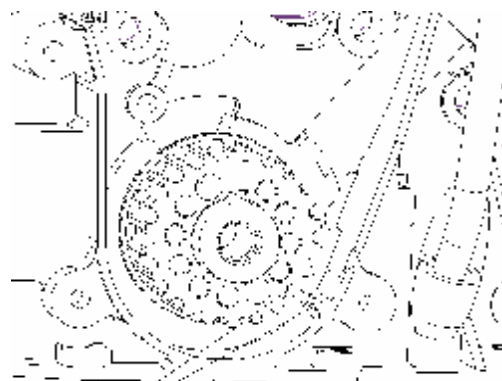


3.2 Installation of timing (at the top dead center of the first cylinder piston)

3.2.1 Put the camshaft timing gear on the front end of the exhaust camshaft, align the locating slot on the gear with the locating pin on the end of the camshaft, and then fix the timing gear with bolts. The tightening torque for the bolts is $100 \pm 5 \text{Nm}$.



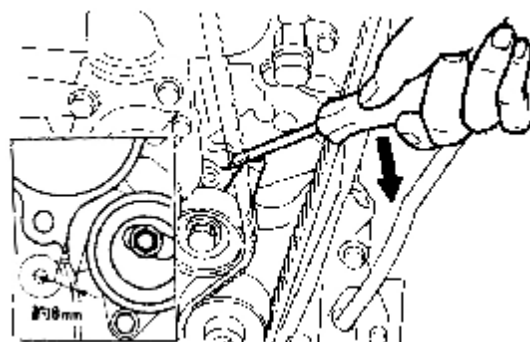
Make sure that the clashing mark of crankshaft timing pulley aligns with the mark of oil pump.



Timing Mark

3.3 Install the tension pulley. After adjust the tension of timing belt, install the tension pulley bolt and tighten it with the torque specified. Adjust the tension of the timing belt according to the following instruction, and install the tension pulley.

3.3.1 As indicated in the figure, make the tensioner swing to the right with a screwdriver so that the distance between the edge of the tension pulley and the circular arc of the water pump body is 8mm, and then tighten the tension pulley bolts with the torque of $25 \pm 3 \text{Nm}$.



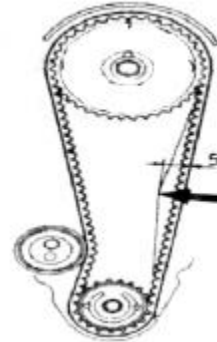
3.3.2 Rotate the crankshaft along the rotating direction of the engine for 2 rounds so that the timing mark on the timing gear of camshaft and crankshaft is matched respectively, and then tighten the crankshaft belt pulley bolts.

3.3.3 The force required to press down the central position between the 2 pulleys at the in-tension side of the timing belt for about 5mm is:

[Reference] 19.6-29.4N(2.0-3.0kg)

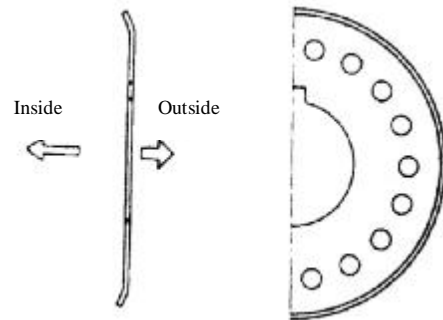
Notice: when the deflection can not reach the standard, it is necessary to adjust the fixing bolt of tension pulley mentioned above.

Tighten the fixing bolt of the tension pulley with the torque as specified. The tightening torque is $25 \pm 3 \text{N.m}$



3.4 Assembly of Timing Belt Back Plate.

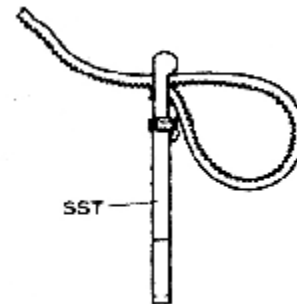
Notice: Install the timing belt back plate in the direction as indicated in the right figure.



3.5 Install the torsional damper with special tools.

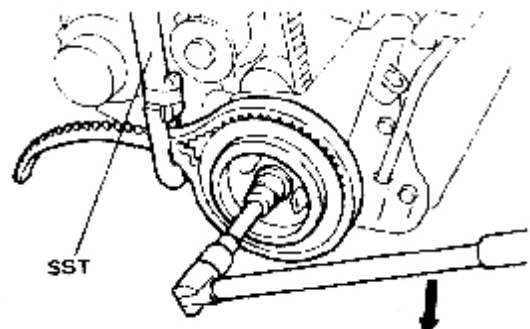
3.5.1 Without flywheel

3.5.1.1 Hitch the part of crankshaft pulley with the belt of special tool.



3.5.1.2 Hold on the handle of the special tool and prevent the toothed belt from rotating. Tighten the bolts with the specified torque.

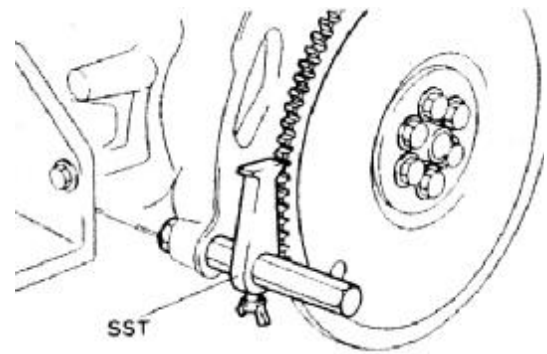
Torque: $98.0 \pm 10 \text{N.m}$ { $10 \pm 1 \text{kgm}$ }



3.5.2 With flywheel

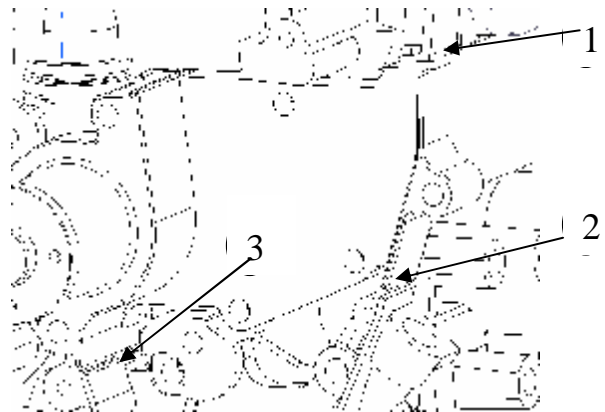
3.5.2.1 Prevent the gear from rotating with special tool.

3.5.2.2 Then screw down the bolt of torsional damper.



3.6 Assembly of timing cover.

Mount the sealing strips at the positions as indicated in the right figure. The sealing strips at the position 1 and 2 should be mounted before the assembly of the cylinder head assembly, and the sealing strip at the position 3 should be mounted before tightening the water pump.

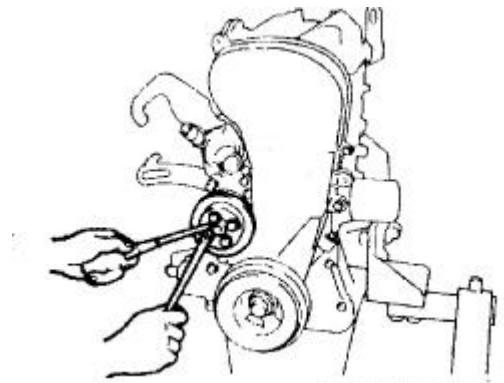


Install the timing cover, screw in the bolts with hand and then tighten them.

Torque: 6±1N.m

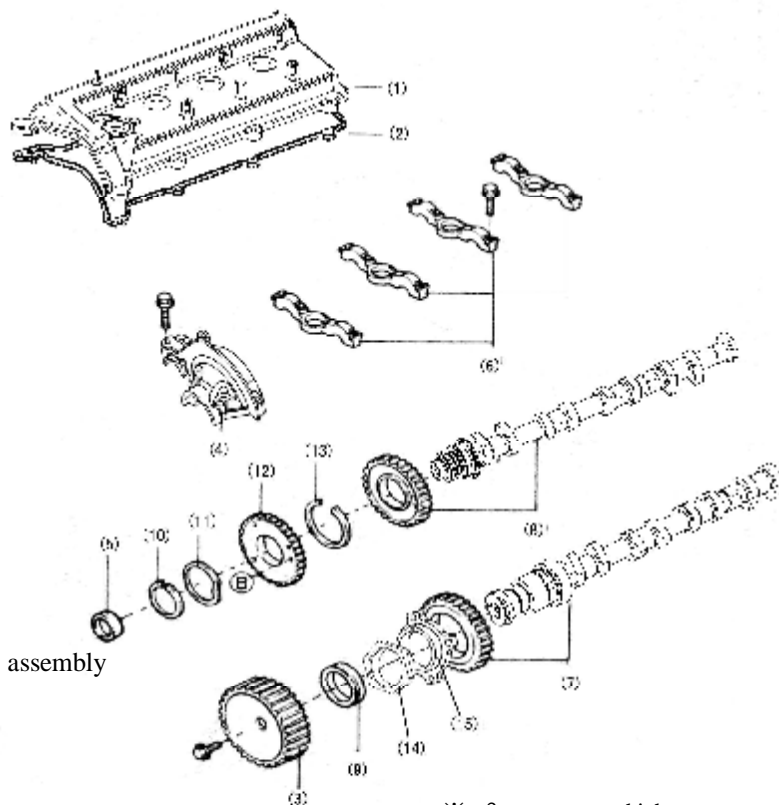
3.7 Installation of water pump pulley.

Torque: 6±1N.m



2) Camshaft

1. Structure Diagram



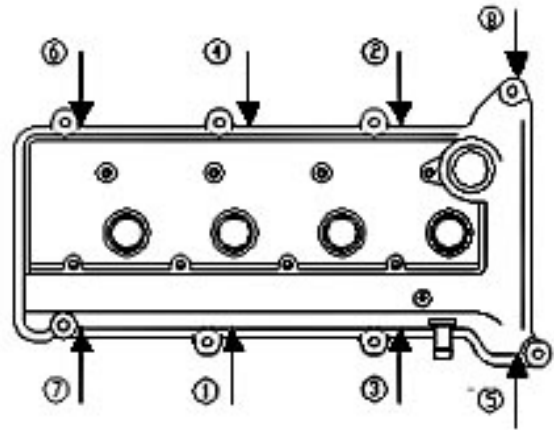
- (1) Cylinder head chamber cover assembly
- (2) Cylinder head cover gasket
- (3) Camshaft timing belt
- (4) Camshaft cover
- (5) Blanking cover
- (6) Camshaft bearing cap
- (7) Exhaust camshaft assembly
- (8) Intake camshaft assembly
- (9) Camshaft oil seal
- (10) Axial spring retainer ring
- (11) Saddle washer
- (12) Intake camshaft sub gear
- (13) Transmission ring

※: Components which may not be reused

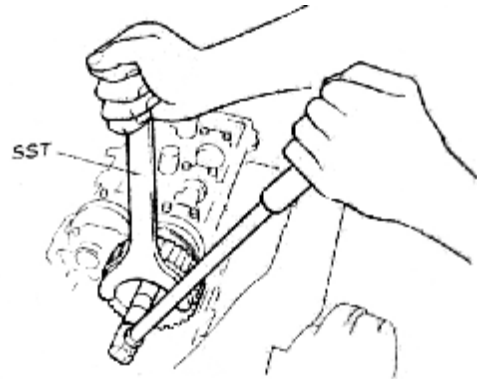
Unit: N·m(kg·cm)

2. Disassembly

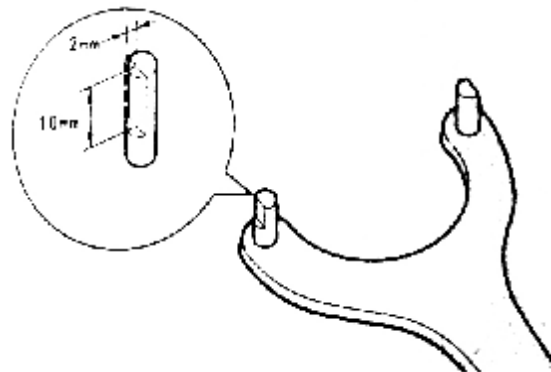
- 2.1 ① Cylinder head chamber cover assembly;
 ② Disassembly sequence of cylinder head chamber cover;



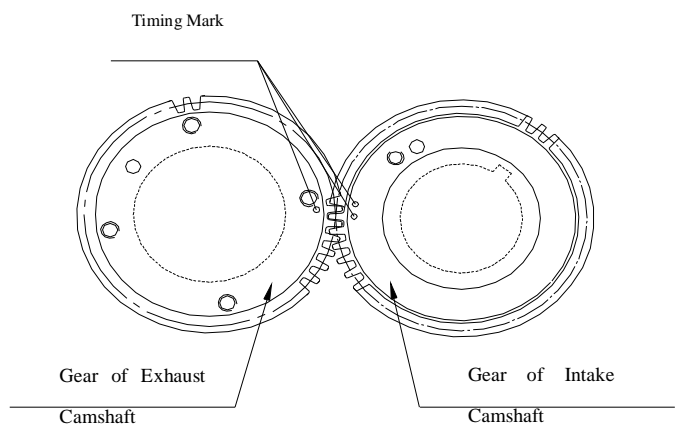
- 2.2 Remove the camshaft timing gear with special tool.



- Notice:** ·The special tool should be made as indicated in the right figure.
 ·Use the special tool to prevent the camshaft from rotating.

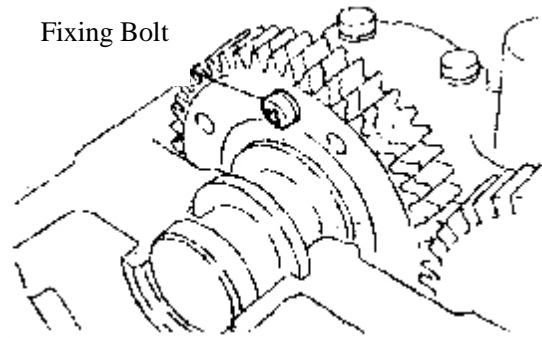


- 2.3 Remove the camshaft bearing cap
 2.3.1 The marks on the camshaft gear should match with each other as indicated in the right figure.

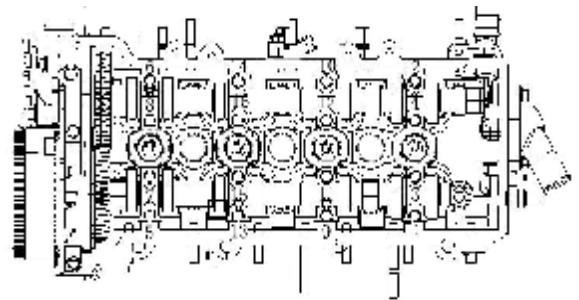


2.3.2 Position the main sub gear on intake camshaft with bolts, as can be seen from the right picture.

Notice: In order to eliminate the radial force of the camshaft, the camshaft should be kept at the horizontal position in the course of disassembly so as to prevent the damage caused by the excessively high radial force.



2.4 Disassemble the bolts in the order as indicated in the right figure, and then disassembly the camshaft bearing cap.



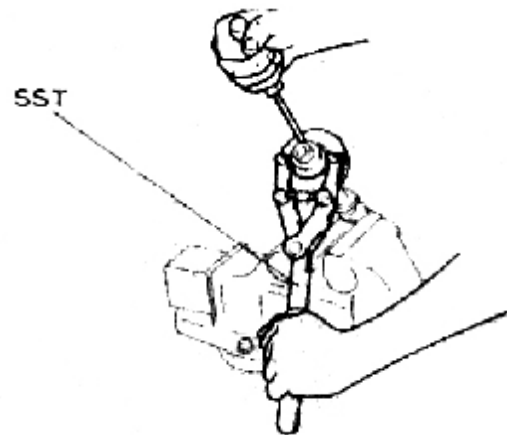
2.5 Remove the spark plug

2.6 Disassemble the sub gear of the camshaft.

2.6.1 If using the special tools, operate as indicated in the right figure.

Clamp the camshaft and plug the pins of special tool into the hole on gear; rotate the gear to keep the meshing of driven gear and driving gear, and then remove the fixing bolt of driven gear.

Notice: The surface of the camshaft may not be damaged.



2.6.2 If not using the special tools, operate as indicated in the right figure.

(1) Screw M6 bolts onto the sub gear of the intake camshaft at the position as indicated in the right figure.

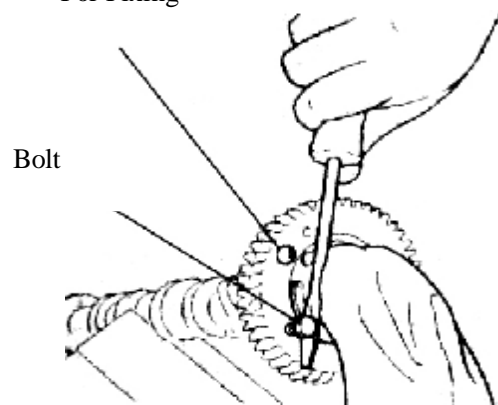
(2) Use the screwdriver to turn the gear as indicated in the figure, and disassemble the fixing bolts of the sub gear.

Notice: The surface of the camshaft may not be damaged.

(3) Disassemble the axial elastic retainer ring with tensioner and remove the saddle spring washer, transmission ring, and so on.

2.7 Camshaft

For Fixing



2.7.1 Measure the camshaft with micrometer caliper. If it is below to the specified limit, replace with a new one.

Camshaft journal Unit: mm

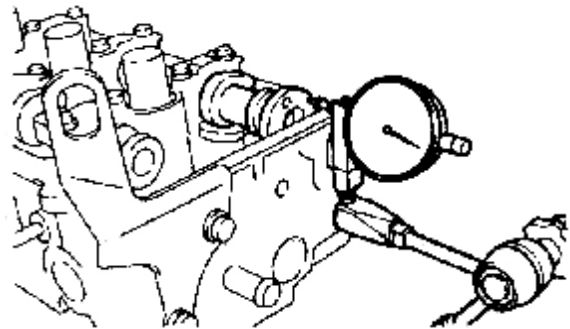
Item	Type	EF	
		ZL, RL	GL, GS, ZS
Standard value	IN	$\phi 23.0^{+0.02}_{-0.033}$	
	EX	$\phi 23.0^{+0.02}_{-0.033}$	
Limit: 0.10	IN	$\phi 22.9$	
	EX	$\phi 22.9$	

2.7.2 Inspection of camshaft axial clearance

(1) Replace the camshaft when the axial clearance value measured with dial gauge exceeds the standard value. The axial clearance of intake camshaft is 0.1~0.170mm.

The axial clearance of exhaust camshaft is 0.1~ 0.173mm.

Limit: 0.18mm.



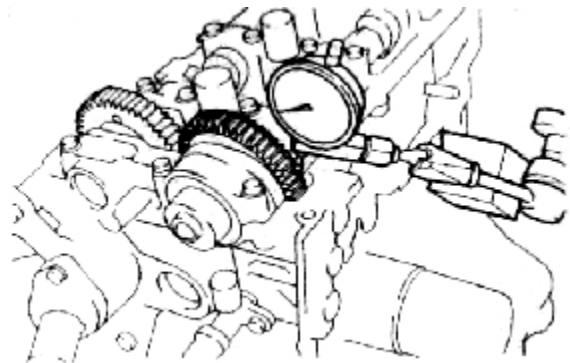
2.7.3 Inspect the clearance of the engaging tooth of camshaft

(1) Install the camshaft into the cylinder head.

(2) Confirm the mark forwards on the bearing cap as well as the axle number, and then tighten the bolts.

(3) Measure the clearance of engaging tooth of the intake camshaft with dia indicator.

- Notice:**
- Measure at 4 points on the circle of the piston
 - Turn the intake camshaft with special tools.
 - Make sure that the marks on the driven gear and the driving gear of the camshaft match with each other.



Inspect the clearance of the engaging tooth of camshaft:

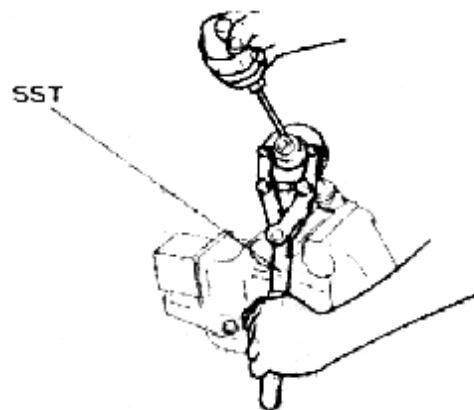
Item	Standard value	Limit
Single tooth	0.04-0.13	0.30

3. Installation

3.1 Under the circumstance that special tools are used:

3.1.1 Fix the 2 holes ($\phi 6$) of the camshaft gear assembly with special tool.

3.1.2 Rotate the driven gear to the right with special tool and tally the mark hole of driven gear with that of camshaft driving gear, or their marking way complies with each other, fix the driven gear with bolts. (Thread: M5; Thread pitch: 0.8)

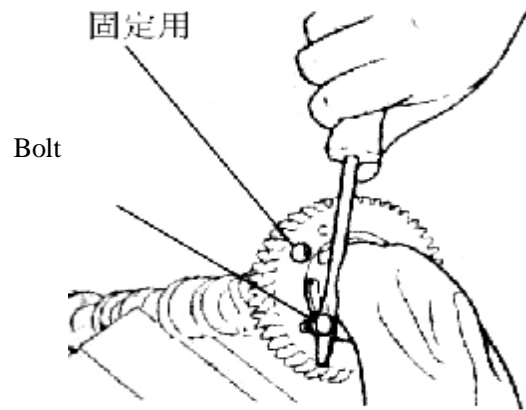


For Fixing

3.2 Under the circumstance that special tools are not available:

3.2.1 Screw the M6 bolts into the camshaft driven gear at the position indicated in the right figure. Insert a screwdriver into the gap between the M6 bolt and the camshaft journal and turn the driven gear rightwards so that the fitting mark of the 2 gears match with each other or the tooth head of the 2 gears accord with each other, and then fix the driven gear with bolts (M5×0.8).

Notice: Don't damage the journal, adjust the operation.



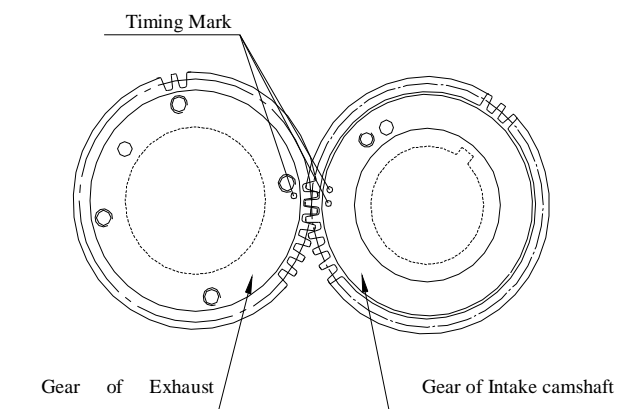
3.3 Assembly of camshaft

Notice: Pay attention to the axial clearance of the camshaft

3.3.1 Spread grease on the gear of camshaft and the axial of cylinder head.

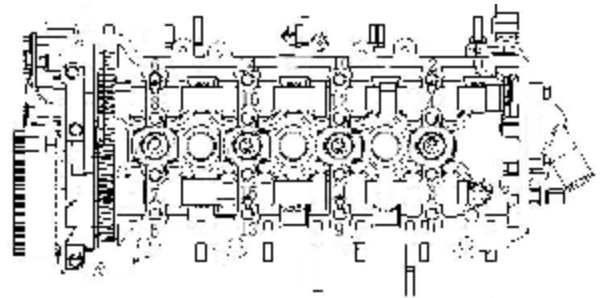
3.3.2 Remove the fixing bolts for camshaft driven gear after mounting the camshaft.

3.3.3 Mount the camshaft, align the timing mark as can be seen from the right picture

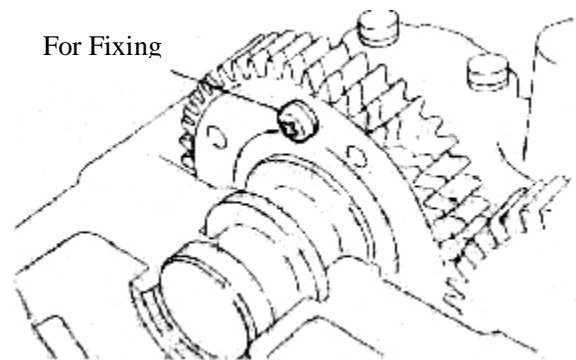


3.3.4 Spread oil fully on the cam of camshaft assembly, gears and axial of cylinder head.

3.4 Tighten the camshaft bearing cap by the order of right picture.



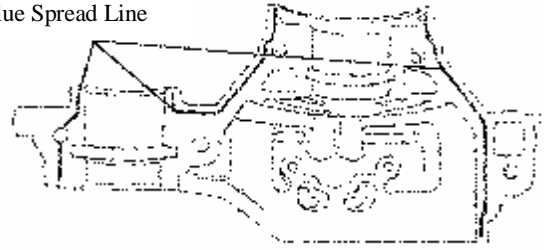
3.5 Screw off the fixing bolts for driven gear of intake camshaft assembly.



3.6 Assembly of camshaft cover

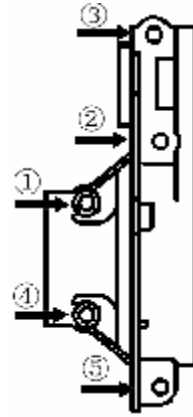
Spread sealant on the position (slot) of camshaft cover as can be seen from the right picture.

Glue Spread Line



3.6.1 Assembly of Camshaft Cover

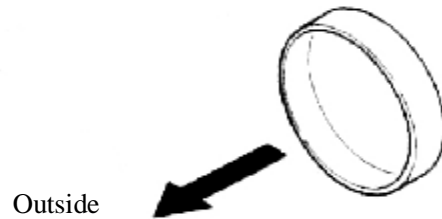
Tighten the bolts in the order as indicated in the right figure and with the specified torque.



3.6.2 After spreading oil on the blanking aperture of cylinder head and the mounting surface of blanking cover, press the blanking cover with special tool.

Notice: The blanking cover should be installed in the direction as indicated in the right figure.

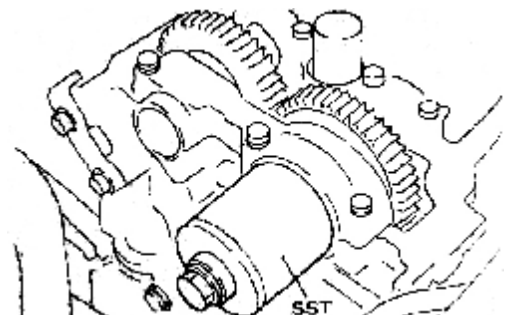
- After being pressed, the blanking cover should be $1\pm 1\text{mm}$ higher than the surface of the cylinder head.



3.7 Spread the edge of the camshaft oil seal with oil, and press it into the cylinder head with M10 bolt (length: 50-60mm) and special tools.

Notice: If the oil seal is reused, spread it with oil before pressing it into the cylinder head.

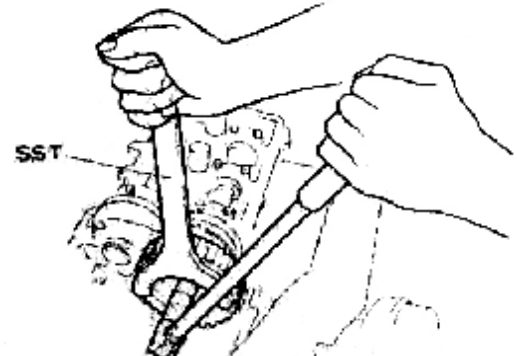
- After removing the bolt, knock it with hand so as to inspect and confirm it.



3.8 Assembly of camshaft timing gear

After spreading sealant on the bolt, prevent it from rotating with special tool and screw down the bolt of camshaft timing gear in specified torque.

Torque: $100\pm 5\text{N.m}$



Notice: Process the special tools as indicated in the right figure before using them.



3.9 Installation of cylinder head cover

3.9.1 The old cushion of the timing belt cover which contacts the cylinder head cover should be removed completely.

3.9.2 Put the new cushion into the groove of the timing belt cover accurately.

3.9.3 Mount the cylinder head cover on the cylinder head, and tighten the 8 bolts in the order as indicated in the right figure and with the specified torque.

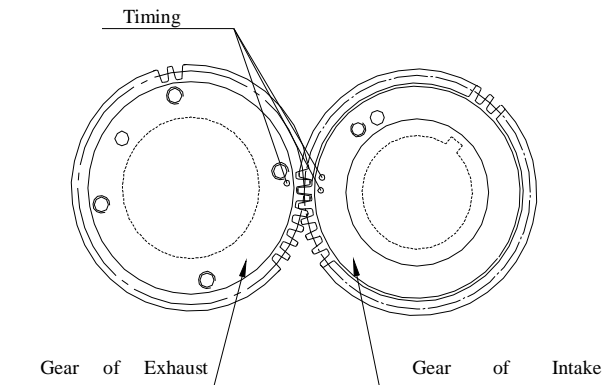
Torque: 6±1N.m

4 Inspection of valve

4.1 Standard valve clearance:

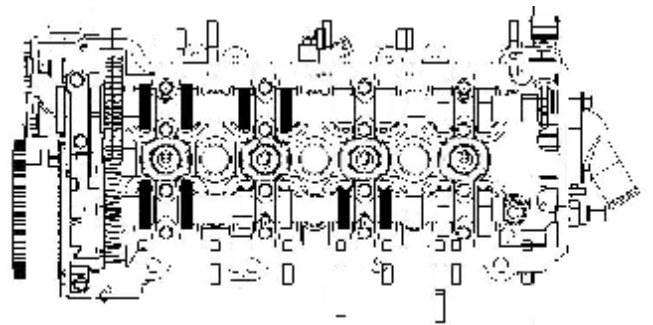
Valve clearance	IN	0.18±0.05
	EX	0.25±0.05

4.2 Make sure that the timing mark on the camshaft driving gear is aligned with that on the camshaft driven gear.

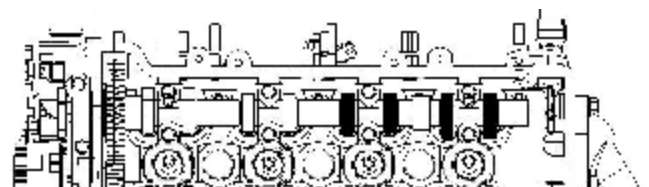


4.3 Inspect the valve clearance as specified in the figure below with the feeler gauge

Cylinder 1		Cylinder 2		Cylinder 3		Cylinder 4	
IN	EX	IN	EX	IN	EX	IN	EX
O	O	O	—	—	O	—	—



4.4 Rotate the camshaft for a round to the position as indicated in the figure, and then measure the valve



clearance once again:

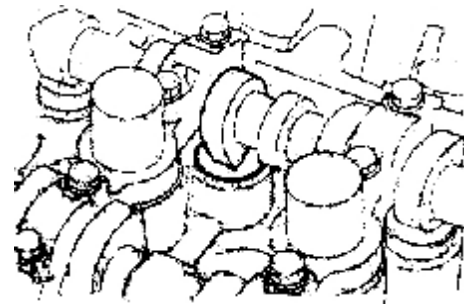
Cylinder 1		Cylinder 2		Cylinder 3		Cylinder 4	
IN	EX	IN	EX	IN	EX	IN	EX
—	—	—	0	0	—	0	0

If the clearance exceeds the standard value, adjust it by replacing the adjustment gasket.

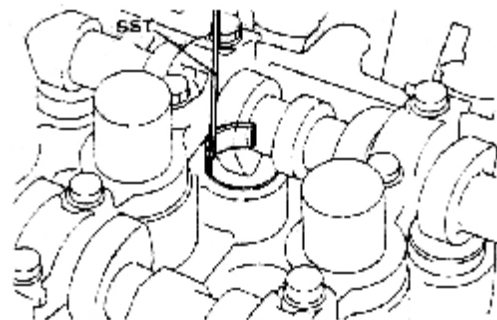
Notice: The position at which the measurement result exceeds the standard value as well as the measurement result should be recorded.

4.4.1 Rotate the camshaft and make the cam head of the cylinder which exceeds the standard value faces upwards and the opening of the valve tappet face inwards.

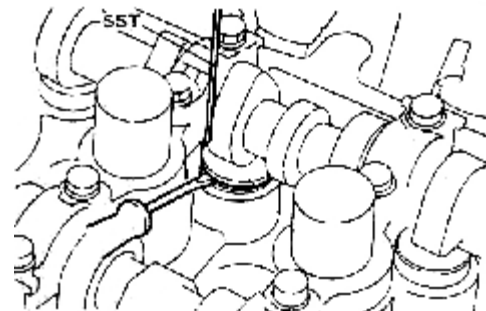
4.4.2 Rotate the crankshaft and press down the valve tappet with the crown head of the cylinder cam.



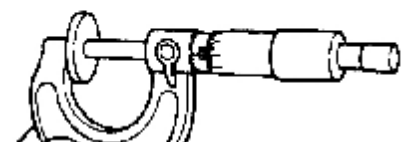
4.4.3 As indicated in the right figure, put special tools on and around the valve tappet from the inside of the cylinder head, and then rotate the crankshaft so that the crown head of the cam face upwards. Press the valve tappet with special tools and hold on.



4.4.3.1 Pry out the adjustment gasket with screw driver, remove the gasket inside with magnet.



4.4.3.2 Adjust the thickness of adjustment gasket with



micrometer caliper.

4.4.3.3 Select the gasket on the basis of the standard value of valve tappet

- ① Intake valve
 Select gasket thickness = Unload thickness + (Measured valve clearance -0.25mm)
- ② Exhaust valve
 Select gasket thickness = Unload thickness + (Measured valve clearance -0.25mm)

[Reference] The 32 kinds of gasket with different thickness are listed in the following table:

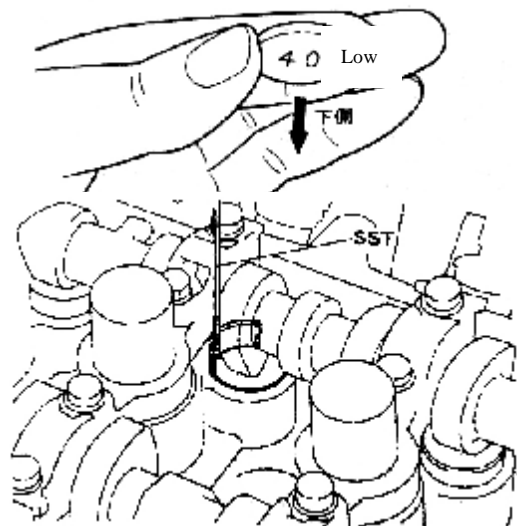
2.18	2.40	2.62
2.20	2.42	2.64
2.22	2.44	2.66
2.24	2.46	2.68
2.26	2.48	2.70
2.28	2.50	2.72
2.30	2.52	2.74
2.36	2.58	2.80
2.32	2.54	2.76
2.38	2.6	

4.4.3.4 Adjust the valve clearance with selected adjustment gasket.

Notice: Install the adjustment gasket with its identification mark facing downwards.

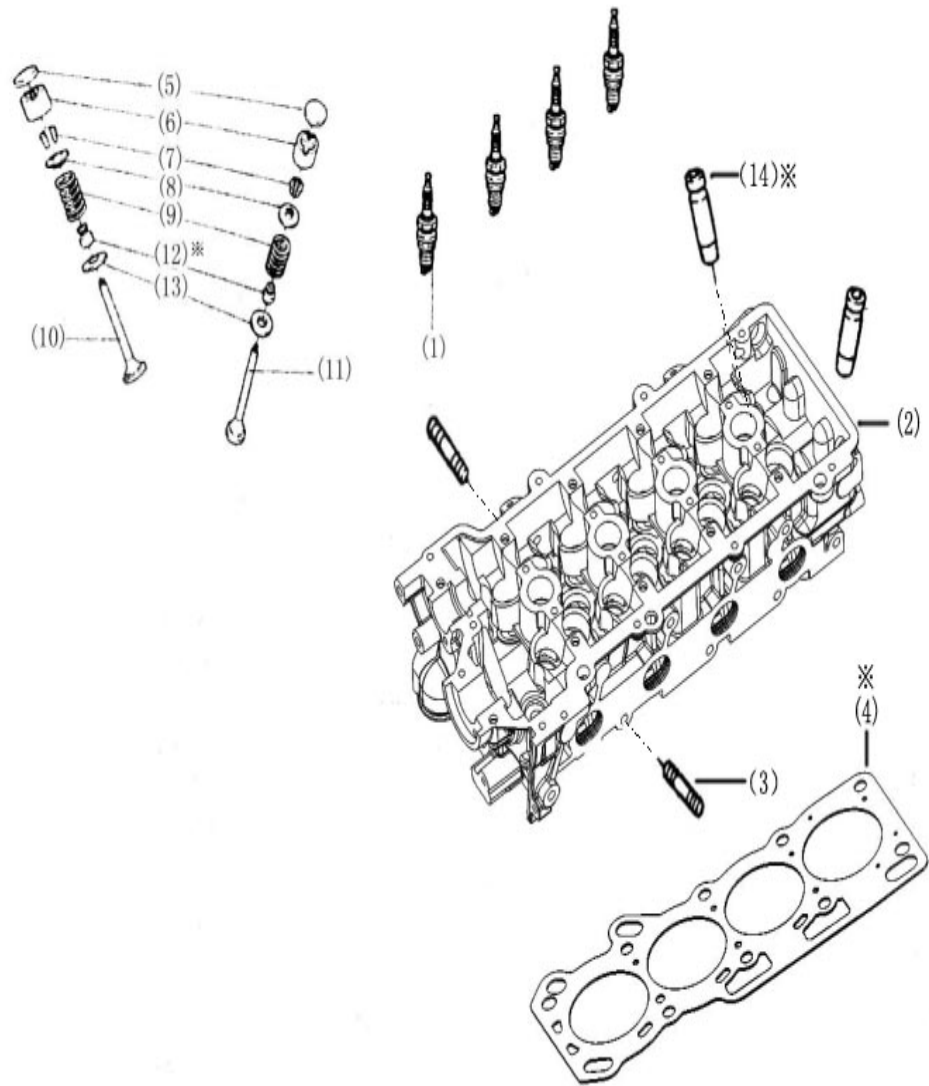
4.4.3.5 Rotate the crankshaft so that the crown head of the cam faces downwards and presses down the the valve. Pick up the special tool.

4.4.3.6 Rotate the crankshaft for 2-3 rounds and confirm once again the valve clearance. If it is still beyond the scope of standard value, adjust and inspect the valve clearance according to the operation specified in 4.1-4.4.



3) Cylinder Head

1. Structure Diagram



- 1 Spark plug 20±1Nm
- 2 Cylinder Head
- 3 Weather Strip I
- 4 Cylinder cushion
- 5 Adjustment gasket
- 6 Valve tappet
- 7 Valve spring retainer
- 8 Valve spring seat
- 9 Valve Spring
- 10 Intake valve
- 11 Exhaust valve
- 12 Valve oil seal
- 13 Valve seat
- 14 Valve guide

※: Components which may not be reused

2. Disassembly

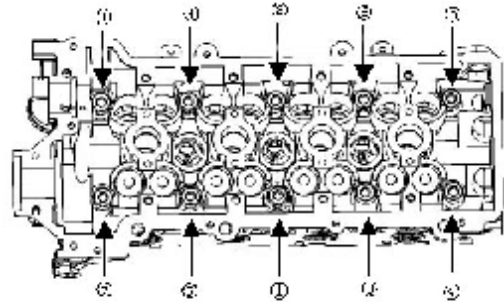
2.1 Disassembly of spark plug

2.2 There are 8 bolts on the cylinder head. In the course



of the assembly of cylinder head, slowly tighten these bolts in the order as indicated in the right figure for several times until they are tightened properly.

Notice: Remove the cylinder head bolts with a torque socket wrench in the contrary order.



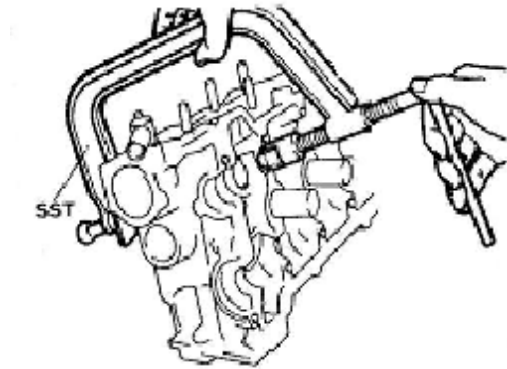
2.3 Disassembly of cylinder head and cylinder head gasket

Notice: The cylinder head gasket is nonreusable.

2.4 Disassembly of valve adjustment gasket and valve tappet

2.5 Disassemble the valve spring retainer lock, spring retainer, spring seat, valve spring, intake valve, and exhaust Valve etc with special tools.

2.6 Disassembly of valve oil seal and valve spring gasket



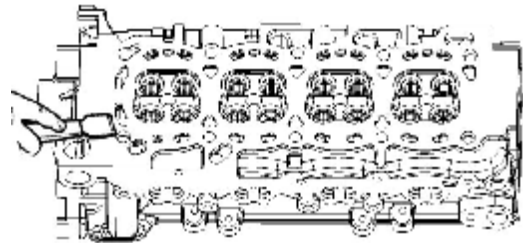
2.7 Cleanup

2.7.1 Clean the carbon dust on the valve.

2.7.2 Clean the bottom surface of cylinder head and the surface of intake and exhaust manifold with scraper knife.

Notice: The surface of the cylinder head may not be scratched in the course of cleanup.

Do not pollute the intake port and water passage.



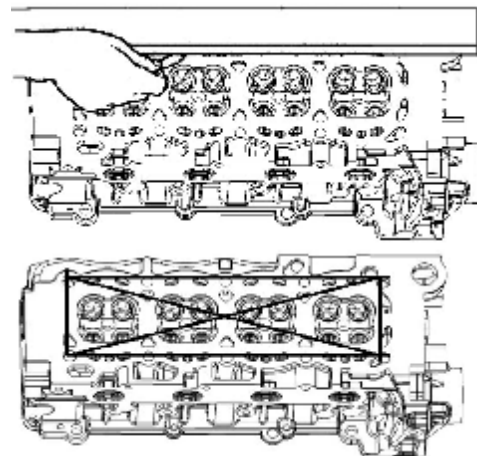
3. Routine Inspection

3.1 Cylinder Head

Measure the flatness at each point with ring gauge as indicated in the figure.

Cylinder head: 0.10mm

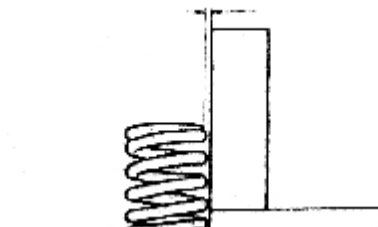
Surface of intake/exhaust manifold: 0.10 mm.



3.2 Valve Spring

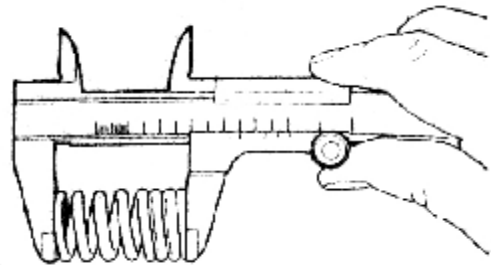
3.2.1 Measure the square degree of valve spring with square. Replace if it exceeds the specified value.

Limit: 1.2mm



3.2.2 Measure the free state of the spring.

Standard value: 37mm



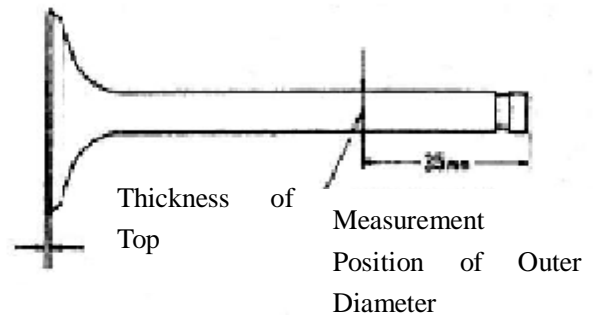
3.3 Inspection of valve

3.3.1 Check if it is deformed or abrades.

Inspection of valve

Unit: mm

Item		Standard value	Limit: 0.10
Width of seal	IN	0.85~1.41	—
	EX	1.07~1.36	—
Thickness of top of valve	IN	1.0±0.2	0.75
	EX	1.0±0.2	0.75



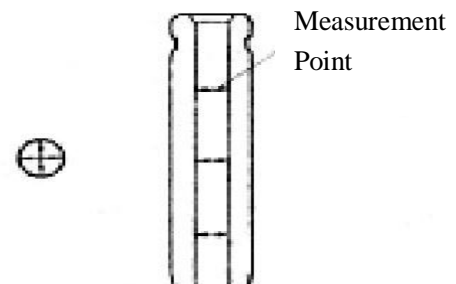
3.3.2 Check the clearance of valve guide and valve stem.

3.3.2.1 Measure the inside diameter of valve guide with dial gauge, the outer diameter of valve stem with micrometer caliper.

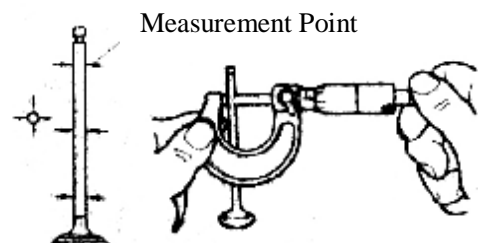
3.3.2.2 Figure out the difference of measured values and the clearance. If the clearance is beyond the specified value, replace valve or guide.

Notice: As can be seen from the right picture, at measuring point, work out the clearance of last abrasion part.

Item		Standard value	Limit: 0.10
Valve guide inside diameter(mm)		φ5.0	—
Valve guide outer diameter(mm)		φ5.0	—
Clearance	IN	0.056~ 0.020mm	0.07
	EX	0.066~ 0.030mm	0.08



Measurement of Valve Guide Inside Diameter

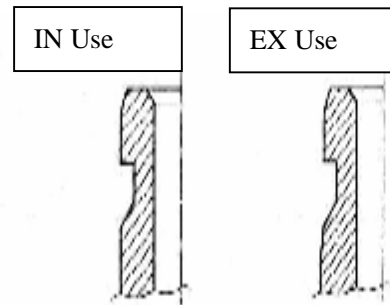
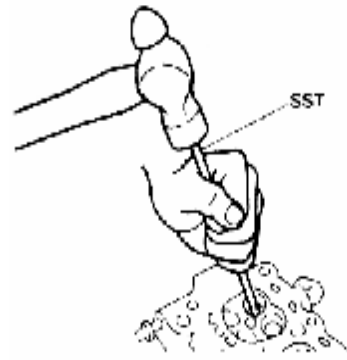


3.3.3 Replacement of valve guide.

3.3.3.1 Heat the cylinder head with hot water to 80-100 °C.

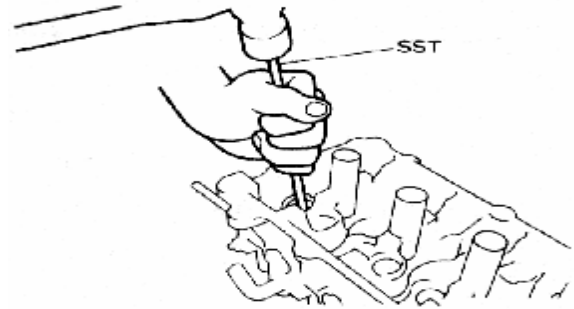
3.3.3.2 Take out the valve guide from one side of combustion chamber with special tool, as can be seen from the right picture.

Notice: The removed valve guide may not be reused. The intake valve guide and the exhaust valve guide may not be mis-installed.



3.3.3.3 Mount the new valve guide with special tool at the place as can be seen from the right picture.

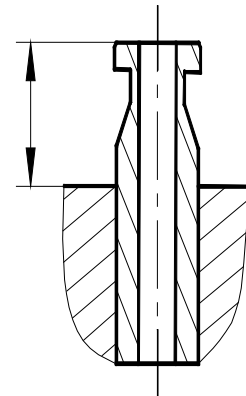
Notice: strike the conduit slowly to the position in the cylinder head; do not strike too far and be careful for size.



The height of the part of valve guide struck into the cylinder head:

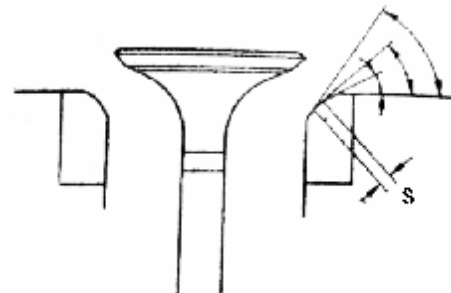
Item	Type	EF	
		GL, ZL, RL, GS, ZS	
Height (mm)	IN		13.71±0.25
	EX		12.11±0.25

3.3.3.4 Rub the inside diameter with reamer to reach the standard clearance value.



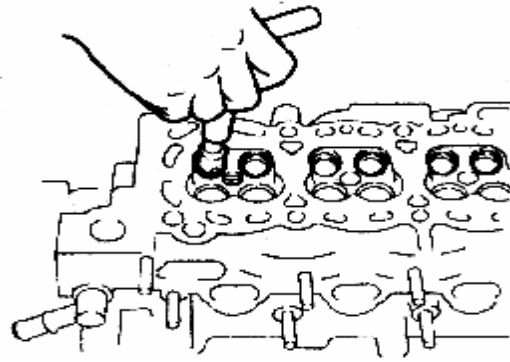
3.3.4 Assorted surface of valve

3.3.4.1 Spread with red lead on the assorted surface of valve. Do not rotate the valve but press lightly and check the assortment and width.



3.3.4.2 Repair of valve seat insert

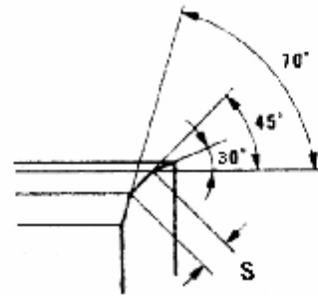
Notice: The repair of valve seat is always conducted in the course of the inspection of valve's fitting position. The surface repaired should be free from any breakage. Take it out slowly after the inspection.



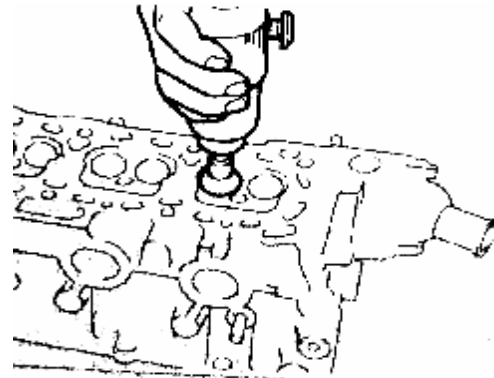
3.3.4.3 45wimble surface is assorted standard value.

3.3.4.4 Inspect the fitting position of the valve. The best position is the center of the valve. If no the valve should be adjusted.

3.3.4.5 Cut wimble surface at the center of assorted position with inner 70and outer 30



3.3.4.6 Prepare for polishing of valve seal.



3.4 Assembly of cylinder head

3.4.1 Cylinder head

Pay attention to the following for installing the other auxiliary part of cylinder head:

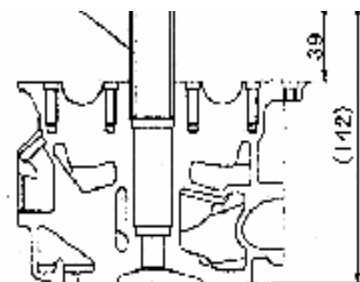
3.4.2 Protective tube of spark plug

1. Press the protective tube of spark plug into the protective tube hole on the cylinder head with the special auxiliary tool. Before pressing, spread the protective tube with sealant. The pressing depth is indicated in the right figure.

Notice: Pay attention to the pressing depth and the uprightness to top of cylinder head when pressing.

During pressing, the protective tube can not be deformed, or leaking will be occurred at the cylinder head cover.

Protective Tube of Spark Plug

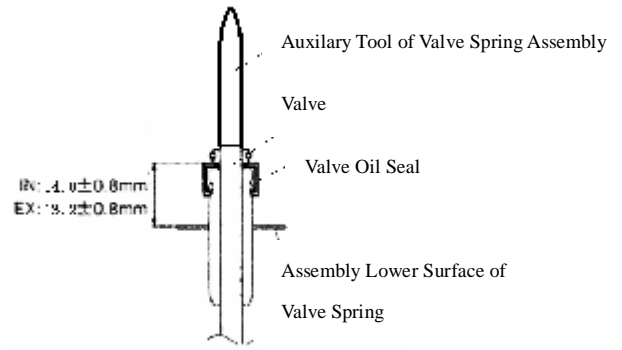


3.4.3 Installation

3.4.3.1 Assembly of valve spring washer and valve oil seal

3.4.3.1.1 Clamp the special auxiliary tool on the top of valve stem and spread oil around the auxiliary tool and the inner of new valve oil seal. Then mount it at the position as can be seen from the picture and pull out the mounting auxiliary tool of valve oil seal.

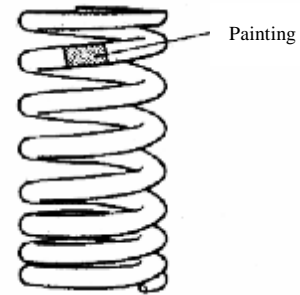
[Reference] After being pressed down, the size of the oil seal should comply with the value indicated in the right figure.



3.4.3.2 Assembly of intake valve and exhaust valve

3.4.3.2.1 Assembly of valve spring.

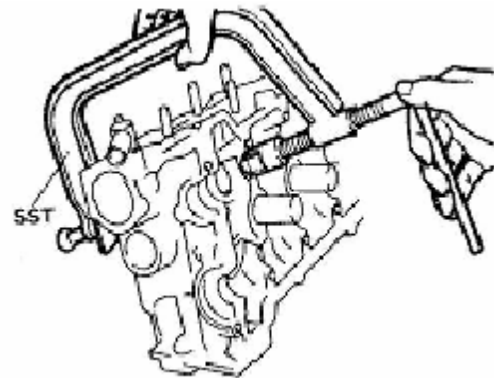
[Notice] The painting is used for recognizing the different suppliers, so the same engine should use the valve spring with same painting.



3.4.3.3 Assembly of valve keeper

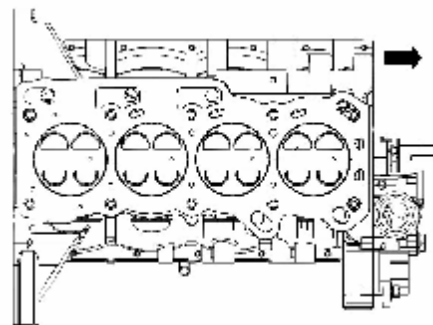
[Warning] Operate with goggle for protecting the eyes.
·Be care for spring jumping out.

After assembly of valve spring and its seat, press the valve spring with special tool and mount the valve keeper.



3.4.3.4 Assembly of valve tappet and valve clearance adjustment gasket

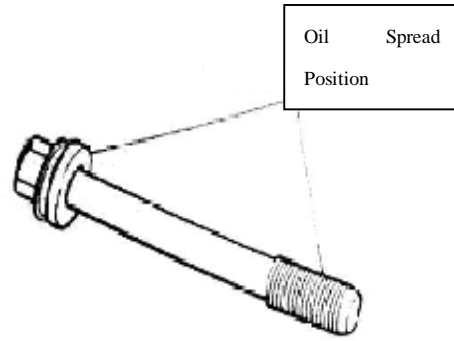
3.4.3.5 Mount the cylinder head gasket and recognize the direction of front and back.



3.4.4 Assembly of dust seal and cylinder head

assembly

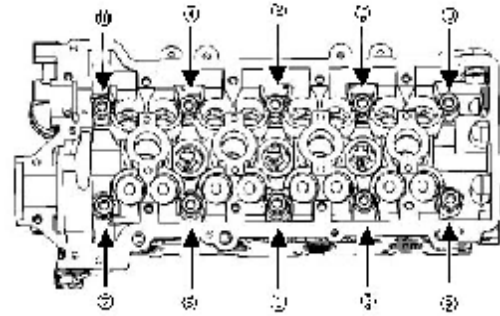
3.4.4.1 Spread a little oil on the flange side of bolt and threaded part



3.4.4.2 Tighten the cylinder bolts in the order indicated in the right figure for 3 times till the torque reaches the specified value. The tightening torque for each time is set forth as follows:

First time: $30 \pm 2 \text{Nm}$; second time: $50 \pm 3 \text{Nm}$; third time: $70 \pm 3.5 \text{Nm}$

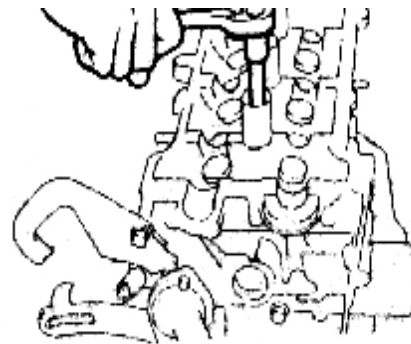
Torque: $70 \pm 3.5 \text{N.m}$



3.4.4.3 Mount spark plug

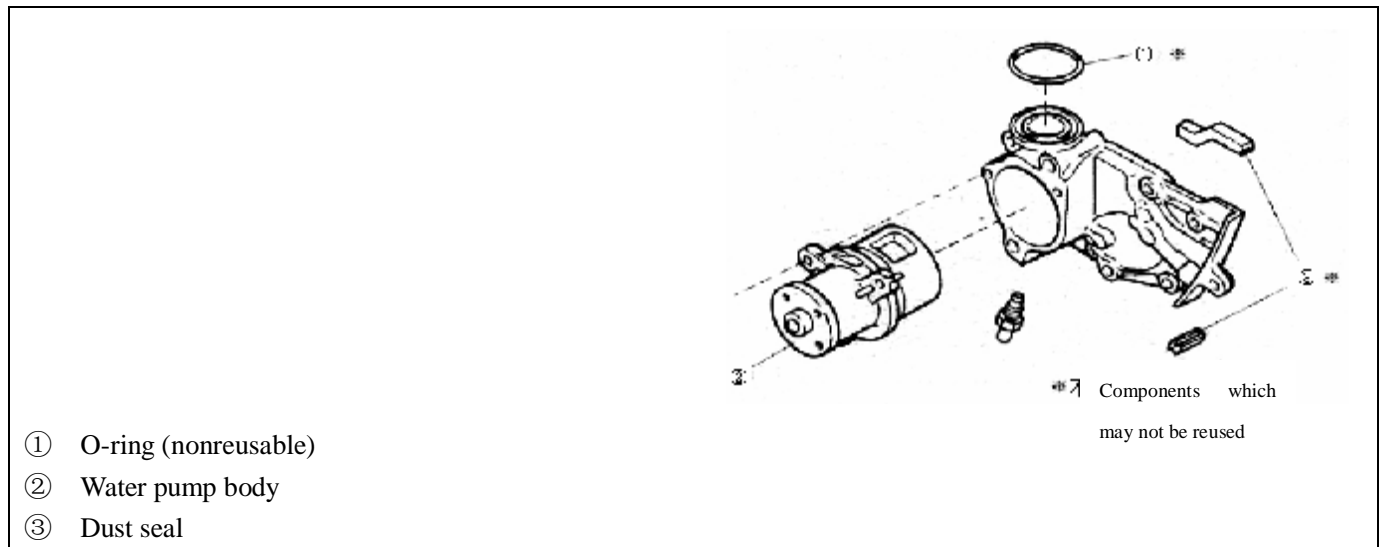
Torque: $20 \pm 1 \text{Nm}$

Notice: Tools should be vertical to prevent the protective tube of spark plug from distorting, or the oil will leak.



4) Water Pump

1. Structure Diagram



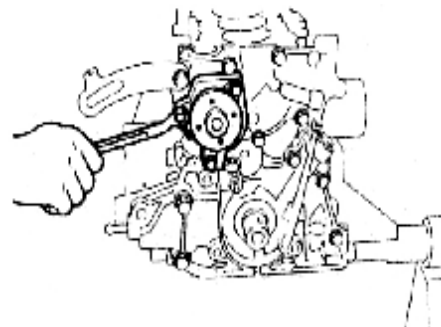
2. Disassembly

2.1.φ Disassembly O-ring

Notice: The O-ring is nonreusable.

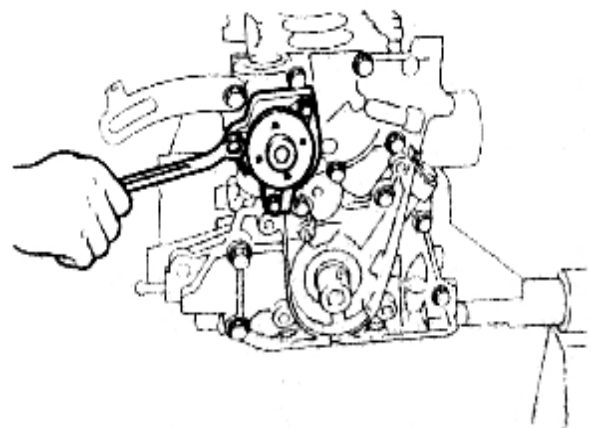
2.2 Screw off 3 bolts and disassemble water pump body.

2.3. Disassembly of dust seal



3. Cleanup

3.1 Clean water pump joint surface.



4. Routine Inspection

4.1 Check if it is deformed.

4.2 Rotate it with hand and inspect whether the rotor rotates and is lubricated well.

5 Assembly

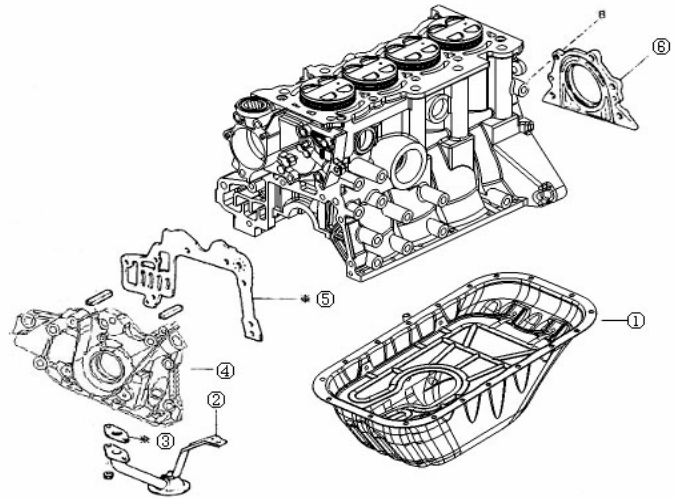
5.1 Mount Dust seal.

5.2 Mount Water Pump Body; torque: $25 \pm 1.5 \text{ N.m}$.

5.3 Mount The New O-ring.

5) Oil Pump

1. Structure Diagram



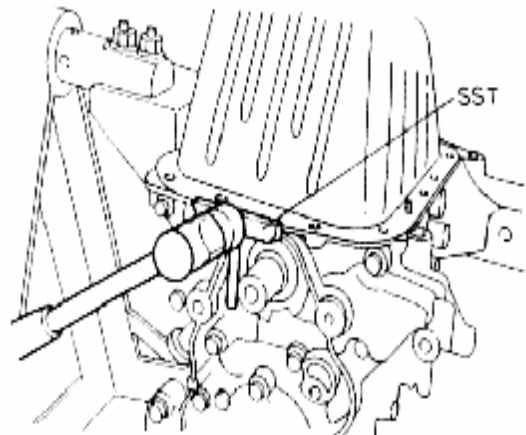
* : Components which may not be reused

- ① Torque for oil pan bolt: 8 ± 2 N.m
- ② Oil collector
- ③ Oil collector spacer (nonreusable)
- ④ Oil pump
- ⑤ Oil pump spacer (nonreusable)
- ⑥ Rear oil seal bracket

2 Disassembly

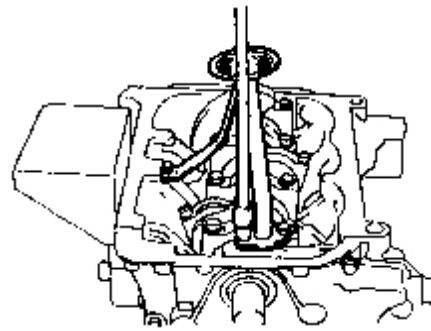
2.1 Screw off the bolts and nuts, and then remove the oil pan from the cylinder body with special tool (The engine is placed on the disassemble shelf upside down).

Notice: Don't make the oil pan flange deform.

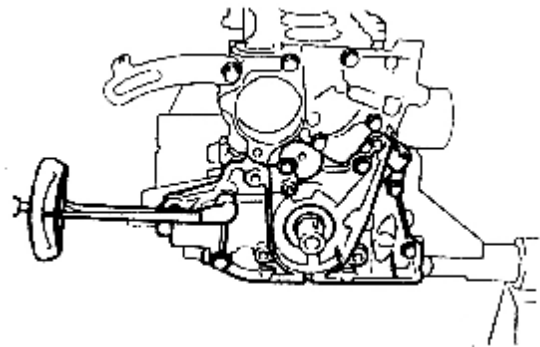


2.2 Remove the engine oil drainer, engine oil collector gasket

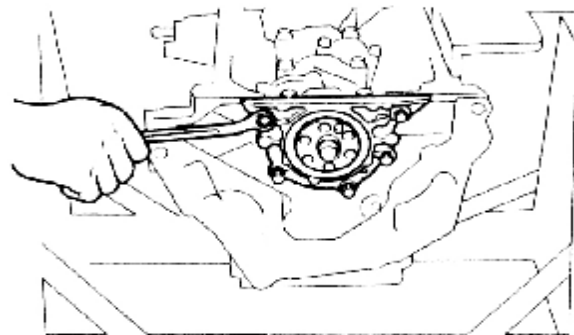
Notice: The oil collector gasket is nonreusable.



2.3 Remove the engine oil pump assembly and the engine oil pump gasket.



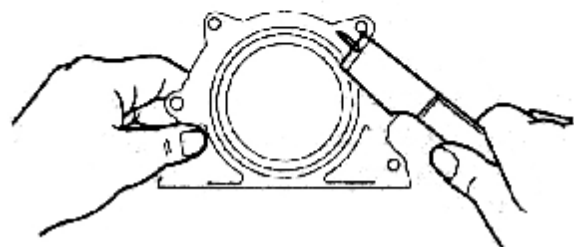
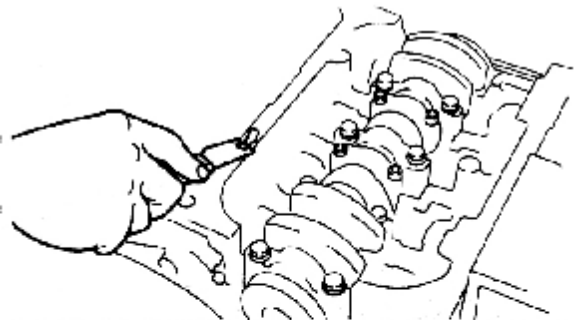
2.4 Remove the rear oil seal bracket.



3. Cleanup

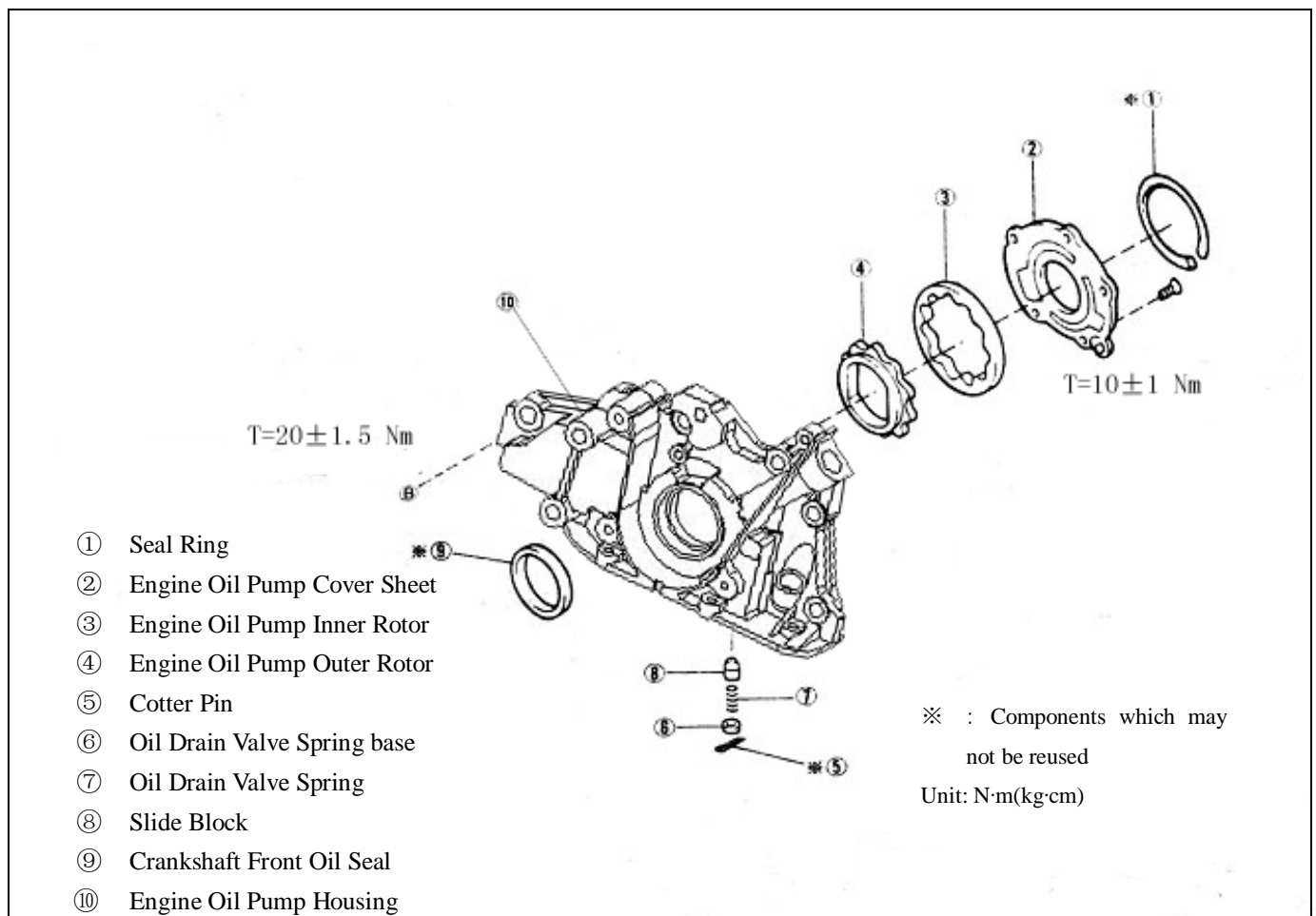
3.1 Remove the old cushion from the oil pan, oil pump and oil pan bracket with a scraper or shovel.

Notice: Don't let the fragment of the cushion fall into the cylinder.



4 Disassembly and Assembly of Engine Oil Pump

4.1 Structure Diagram



4.2 Disassembly

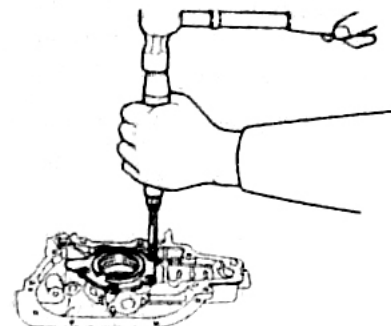
4.2.1 ① O-ring

Notice: The O-ring is nonreusable.

4.2.2 Remove the oil pump cover

Notice: If the screws are tightened, use a screw driver to remove them as indicated in the figure.

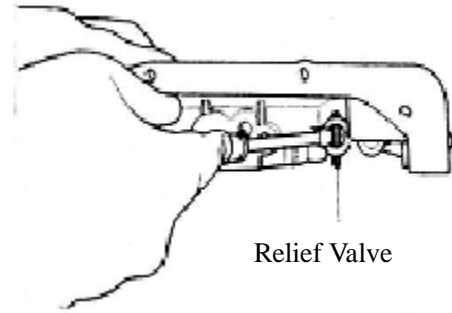
4.2.3 Remove the inner rotor, outer rotor of the engine oil pump.



4.2.4 Remove the cotter pin

Notice: The cotter pin is nonreusable.

Notice: When removing the cotter pin, be careful not to let the spring or the spring seat spring out or fall off abruptly.



Relief Valve

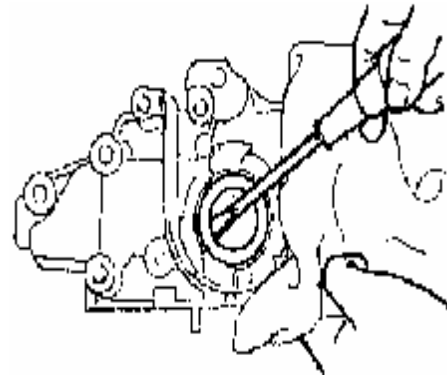
4.2.5 Remove the spring seat of the oil pressure relief valve for the engine oil pump, the coil spring, oil pump and oil pressure relief valve etc.

Slide Block Relief Spring Spring Seat



4.2.6 Remove the front crankshaft oil seal.

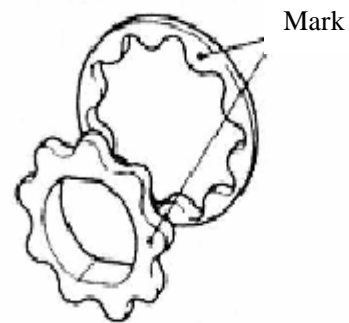
Notice: The oil seal removed may not be reused.



4.3 Routine Inspection

4.3.1 Inspect the engine oil pump for clearance.

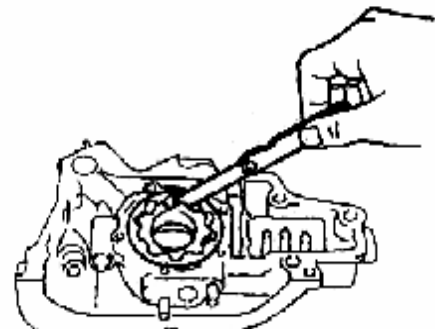
4.3.1.1 According to the marks for inner gear and outer gear in the engine oil pump, put the gears into the engine oil pump that is in the cylinder block.



4.3.1.2 Measure the clearance between the inner and outer gears with a feeler gauge

Standard value: 0.05-0.18mm (average value of 9 positions)

Limit: 0.35 mm



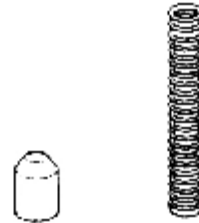
4.3.1.3 Measure the clearance between the rotor and pump body.

Standard value: 0.10-0.181mm

Limit: 0.25 mm

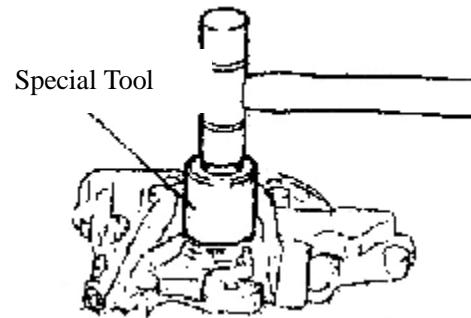
4.3.2 Inspect the oil pressure relief valve

4.3.2.1 No abrasion or scrape shall be found on the oil pressure relief valve.



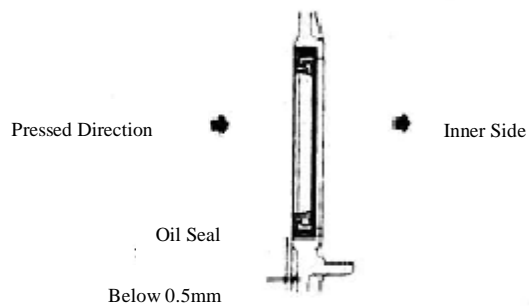
4.4 Installation

4.4.1 After the lip of the new oil seal for front crankshaft is spread with engine oil, fix it with a special tool.



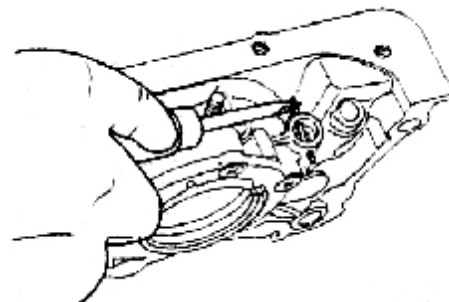
Notice: Use new oil seal

The oil seal should be left less than 0.5 mm at its outer edge after it is pressed down.

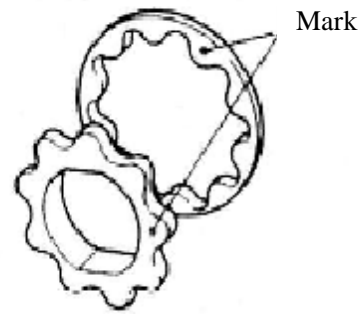


4.4.2 Assembly of the oil pressure relief valve for engine oil pump and the cotter pin.

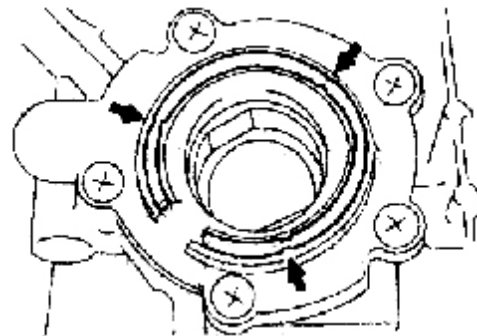
Notice: The cotter pin is nonreusable.



4.4.3 When the outer gear or inner gear is put into the engine oil pump, its mark should be seen.

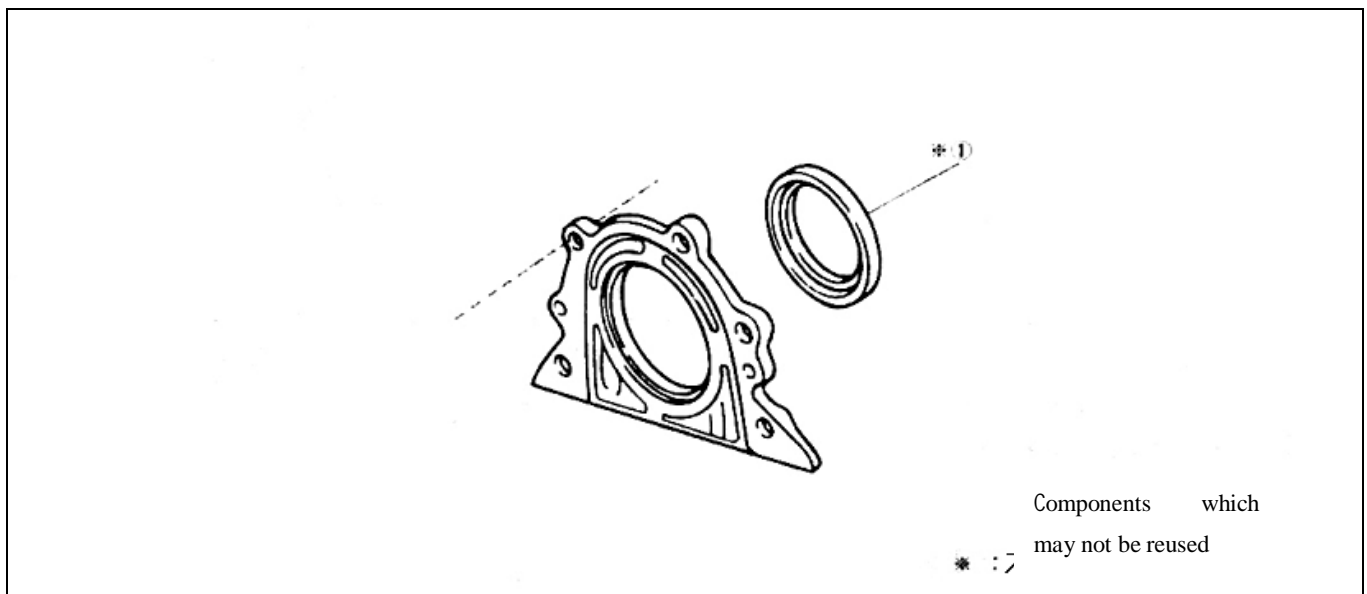


4.4.4 The new weather strip should be fixed in the groove of oil pump cover.



5. Disassembly of Oil Seal

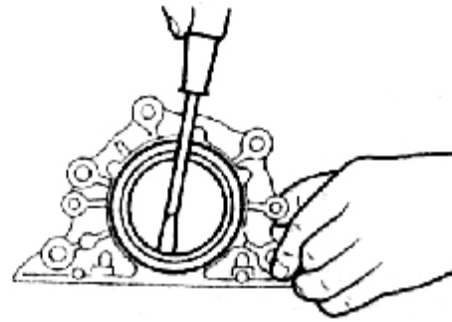
5.1 Structure Diagram



5.2 Disassembly

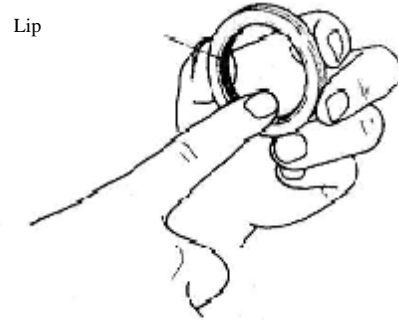
5.2.1 Remove the rear crankshaft oil seal with a screwdriver.

Notice: The rear oil seal of the crankshaft is nonreusable.



5.3 Inspection

Inspect the oil seal for damage and the abrasion at its lip.

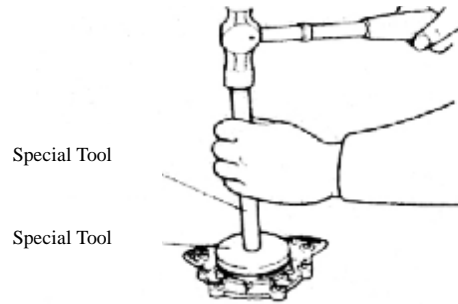


Lip

5.4 Assembly of oil seal

5.4.1 Spread engine oil over the lip of the new oil seal.

5.4.2 Mount the oil seal with special tool as indicated in the right figure



Special Tool

Special Tool

6. Assembly

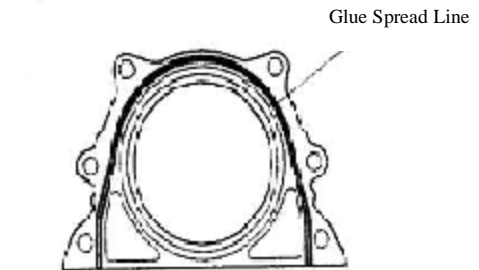
6.1 Assembly of the oil seal seat

Spread sealant over the oil seal seat as shown in the right figure.

Grease: Loctite 5699

Notice: Spread the liquid sealant on the position of the oil seal base which is to contact with the cylinder body, and make sure the width of the sealant is 3-4mm.

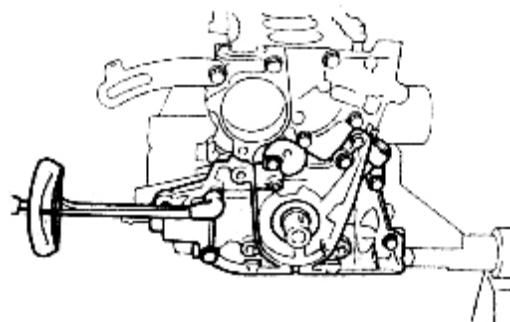
Torque: $25 \pm 1.5 \text{ N.m}$



Glue Spread Line

6.2 Assembly of the new engine oil pump gasket and the engine oil pump assembly.

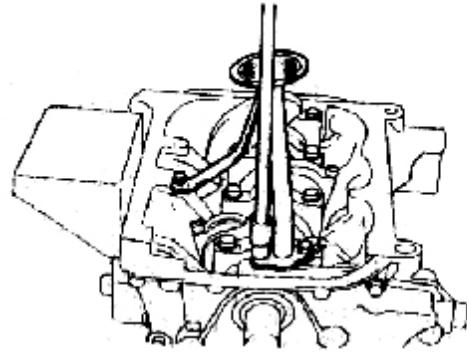
Torque: $20 \pm 1.5 \text{ N.m}$



6.3 Assemble the new engine oil collector gasket and the

engine oil drainer

Torque: 6±1N.m



6.4 Assembly of the oil pan

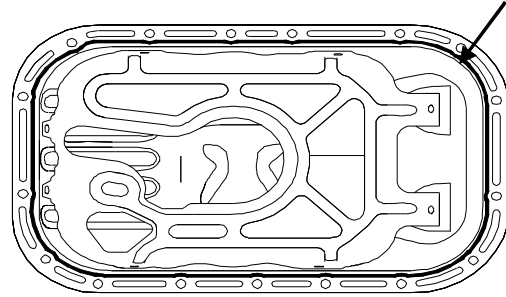
6.4.1 Clean up the joint surface between the oil pan with the cylinder.

6.4.2 Spread sealant, then assemble it.

Grease: Loctite 5699

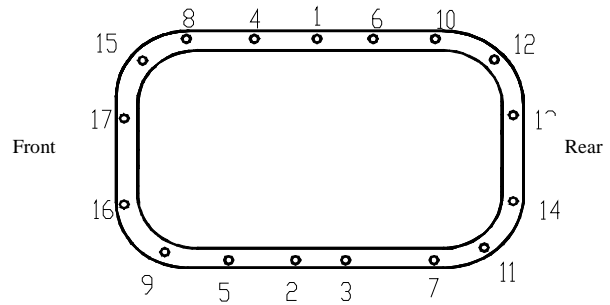
Notice:

- The sealing line should be unbroken with its diameter being $\phi 3-4\text{mm}$
- Assembly should take place fifteen minutes after glue-spreading.



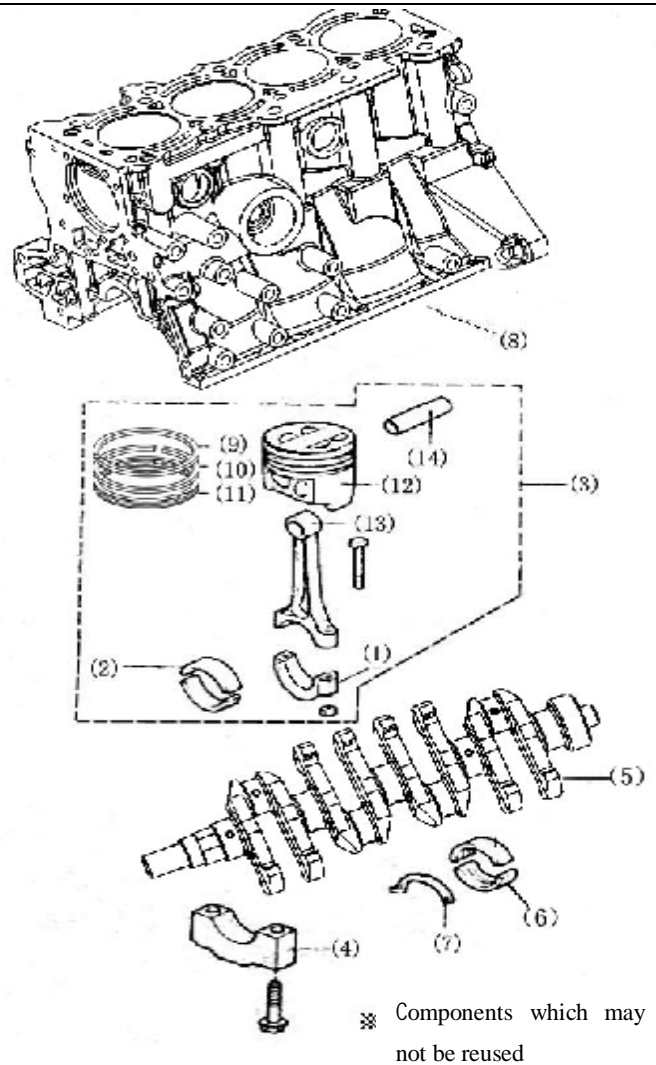
6.4.3 Tighten the bolts in the middle first up to the specified torque, then the bolts beside them as shown in the right figure.

Torque: 6±1N.m



6) Crank Connecting Rod Mechanism

1 Structure Diagram



- ① Connecting rod cover
- ② Connecting rod bushing
- ③ Piston connecting rod assembly
- ④ Main bearing cap
- ⑤ Crankshaft
- ⑥ Crankshaft bearing bushing
- ⑦ Thrust plate
- ⑧ Cylinder body
- ⑨ First ring
- ⑩ Second ring
- (1) Steel tape combined oil ring
- (12) Piston
- (13) Connecting rod
- (14) Piston pin

2 Disassemble of Crank Connecting Rod Mechanism

2.1 Inspect the axial momentum of the connecting rod

2.1.1 Measure the axial clearance with a dial gauge or feeler gauge.

Standard value: 0.15-0.25mm

Limit: 1.2mm

2.2 Inspect the connecting rod bushing for its radial clearance.

2.2.1 Remove the bushing cap.

Notice: The components of each cylinder shall be placed in order.

2.2.2 Clean the bearing bushing and the axle.

2.2.3 Conduct radial adjustment for the axial diameter of connecting rod with clearance gauge.

Tighten the bushing cap with specified torque.

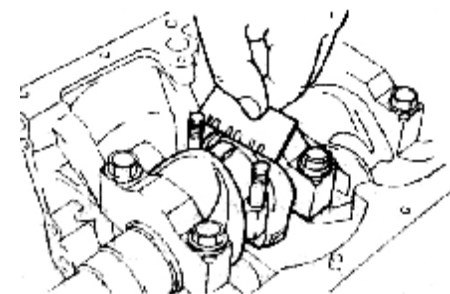
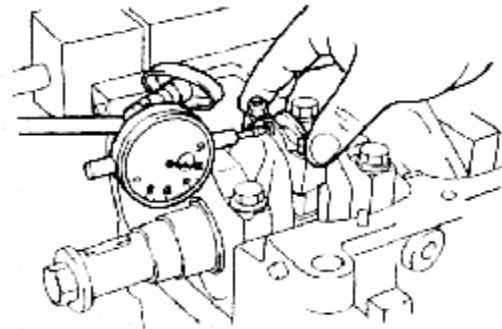
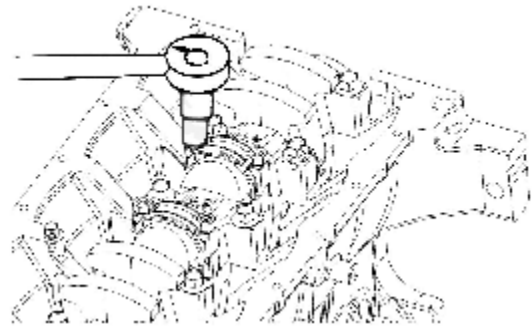
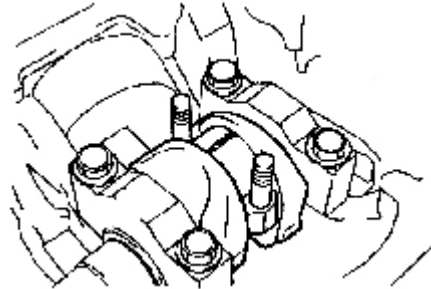
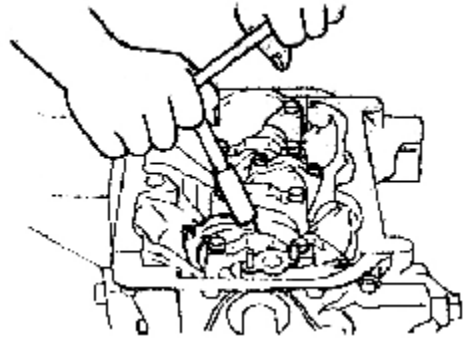
Torque: $40 \pm 2 \text{N.m}$

Notice: The crankshaft may not rotate.

2.2.4 Remove the bushing cap, measure the maximum thickness of the searcher.

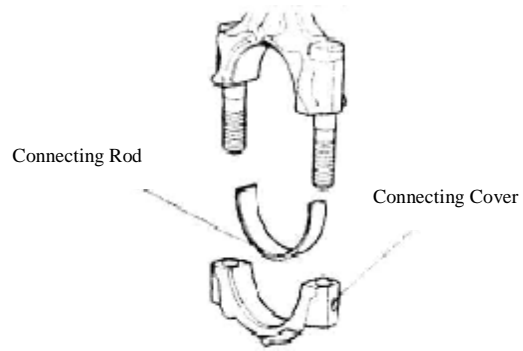
Standard value: 0.020-0.044 mm

Limit: 0.07 mm

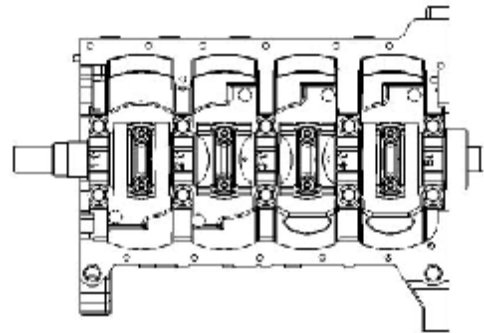


2.2.5 If it is beyond the limit, replace the bearing bushing.

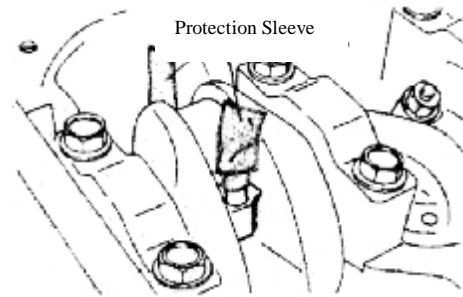
Notice: Replacing the bearing bushing with the product of the same manufacturer's brand. The thickness of the connecting rod bushing which meets the requirements of clearance = diameter of big end hold – axial diameter of connecting rod – standard value of bearing bushing clearance



2.2.6 Remove the connecting rod bearing cap and the connecting rod bearing bushing



2.2.7 Put vinyl-resin protecting jacket on the threaded part of the connecting rod bolt so as to prevent the bolts from scraping the cylinder hole and the crankshaft connecting rod journal, and then disassemble the piston connecting rod by using the hammer handle striking it out.



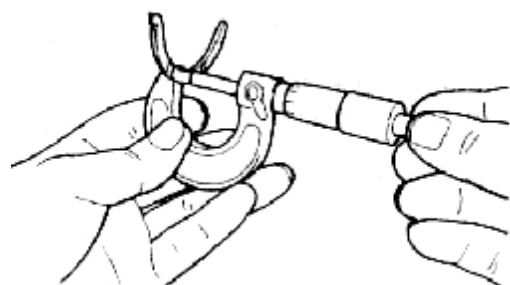
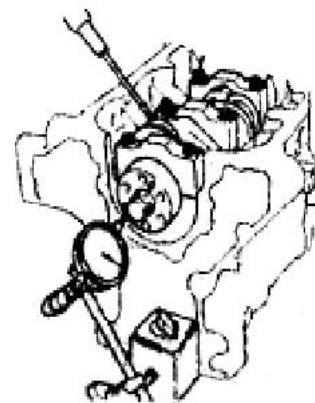
2.3 Inspect the axial clearance of crankshaft

2.3.1 Measure the axial clearance of the crankshaft with a dial gauge, if it is beyond the limit, it is necessary to replace the axial thrust plate or the crankshaft.

Standard value: 0.089-0.211mm

Limit: 0.30mm

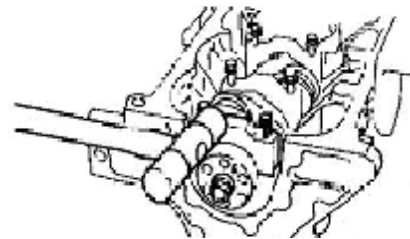
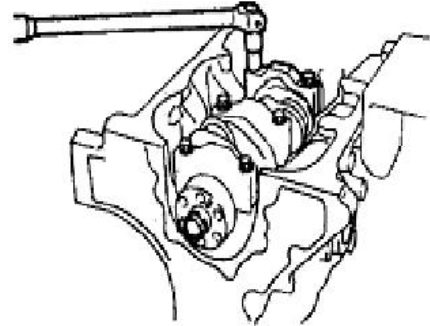
Item	Standard value
	$1.9^{+0.11}_{-0.03}$



2.4 Inspect the crankshaft for its radial clearance.

2.4.1 Remove the crankshaft bearing cap by softly tapping with a resin hammer.

2.4.2 Clean the inside and surface of the bearing bushing, the inside and surface of the bearing cap, the cylinder wall and journal. Inspect them for abrasion and damage carefully.



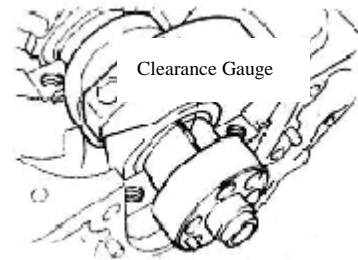
Protection Sleeve

2.4.3 Adjust the radial clearance of the crankshaft with a clearance gauge, and tighten the bearing bushing cover bolts with the specified torque.

Torque: $70 \pm 3.5 \text{ N.m}$

Notice: After tightening the bolts, the rotating torque of the crankshaft should be less than 1Nm

(The torque of crankshaft without piston connecting rod)

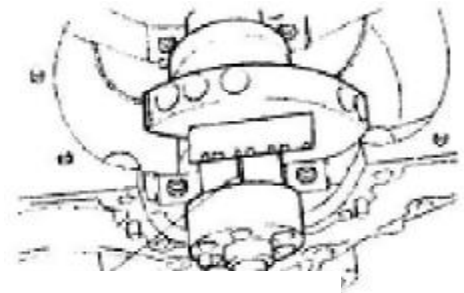


Clearance Gauge

2.4.4 Remove the bearing cap and measure the maximum width with a clearance gauge. If the measurement result exceeds the limit, replace the bearing bushing.

Standard value: 0.025-0.069mm

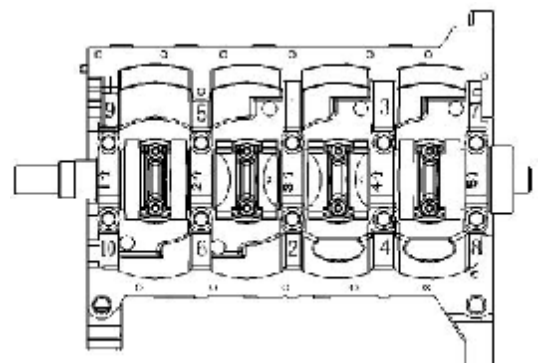
Limit: 0.10mm



Width Compare of Clearance Gauge

2.4.5 Remove the main bearing bushing cap of the crankshaft, crankshaft, crankshaft bearing bushing and crankshaft axial thrust plate

Notice: Tighten the bolts for the crankshaft bearing cap in the order shown in the right figure. Tighten the bolts for three times, then the torque must be up to the specified value.



2.5 Disassembly and assembly of the piston and connecting rod assembly

2.5.1 Remove the first ring, second ring and the oil ring with a pair of piston ring moving pliers.

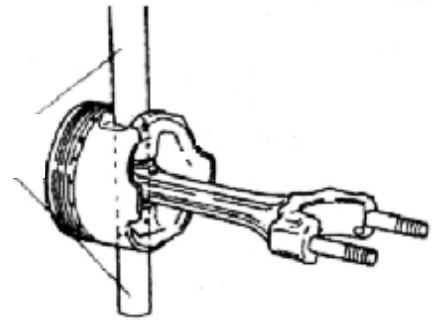
Notice: Don't get the piston and piston ring of each cylinder confused.



2.5.2 Remove the piston, connecting rod and the piston pin with special tool.

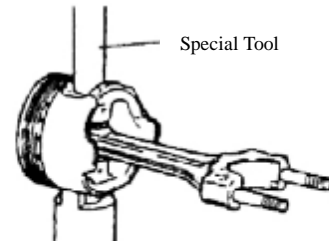
Disassemble the piston pin with special tool as indicated in the right figure.

Special Tool



① As indicated in the right figure, disassemble the piston which is at the state mentioned above with special tools. Remove the piston pin with special tool, and then remove the piston and the connecting rod.

Special Tool

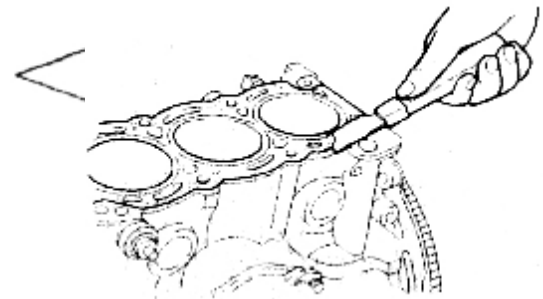


3 Cleanup

3.1 Cylinder Body

Warning: In the course of cleanup, protect your eyes with eyeglass.

3.1.1 Clean up the cylinder body, cylinder head, oil pan, oil pump and the oil seal with a flat blade.



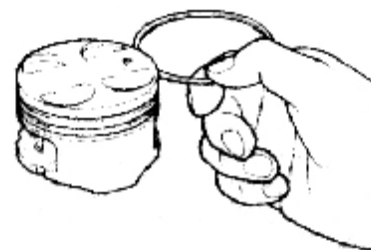
3.2 Piston

Warning: In the course of cleanup, protect your eyes with eyeglass.

3.2.1 Use an old ring to remove the carbon in ring groove.

3.2.2 Remove the carbon of parts with scavenger.

Notice: Don't use hard articles such as metal brush.



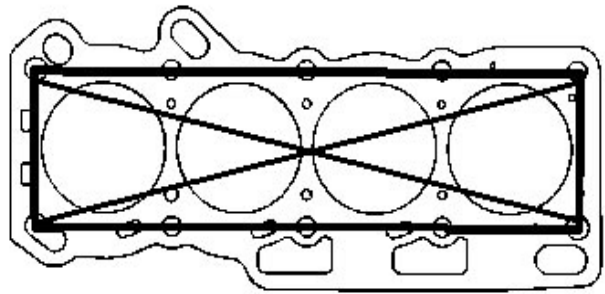
4 Routine Inspection

4.1 Cylinder Body

4.1.1 Inspect the top surface of cylinder body for its flatness

(1) Measure at the six points shown in the right figure with a ruler and a feeler gauge.

Limit: 0.08mm



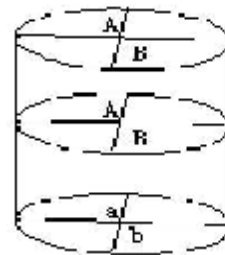
4.1.2 Use of bore gauge

Measure the cylinder bore at the positions as indicated in the right figure with a bore gauge, and figure out the difference between the maximum value and the minimum value. If the difference exceeds the limit, repair or replace the cylinder.

Limit: 0.03mm

[Reference] Roundness: A-B or a-b
Cylindric degree: A-a or

[Reference] Standard diameter of cylinder:
 $\phi 72.00-72.01\text{mm}$



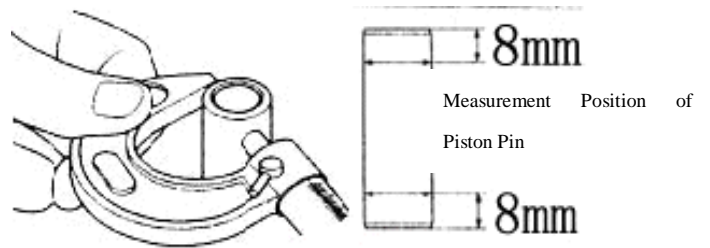
Upper Stopper Position of Piston

Lower Stopper Position of Piston

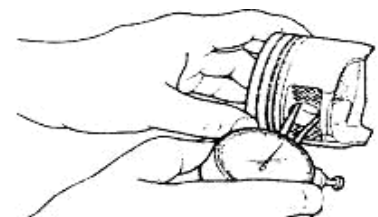
4.2 Piston

4.2.1 Inspect the piston pin hole for its clearance

Measure the piston pin at several positions with a micrometer caliper shown in the figure, make the maximum value as the diameter of pin.



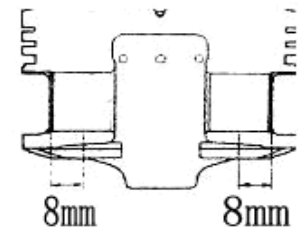
4.2.2 Measure the diameter of piston pin at several positions with an inner-diameter dial gauge as shown in the figure, make the minimum value as the diameter of the pin hole.



Work out the clearance with the difference between the pin diameter and pin hole diameter, if the difference is beyond the standard value, replace the piston pin or piston.

Standard value: 0.004-0.009mm

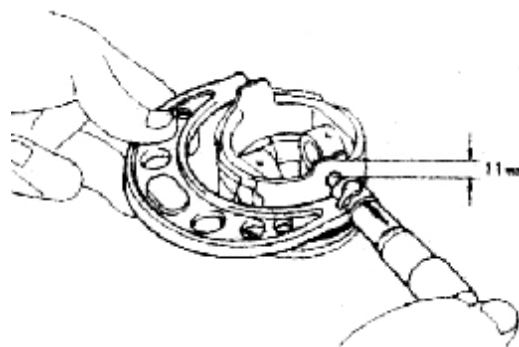
Limit: 0.015mm



4.2.4 Measure the diameter of the piston

4.2.4.1 Measure at about 11 mm to the bottom of the piston, along the direction vertical to the piston pin.

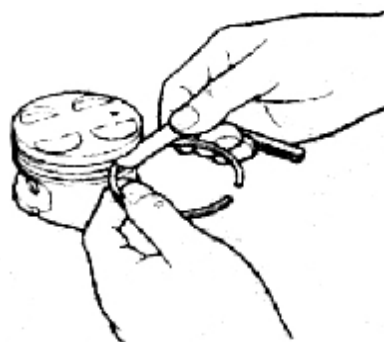
Standard value: $f72_{-0.025}^{-0.013}$



4.2.5 Inspect the clearance between the piston ring and the ring groove

4.2.5.1 Measure around the ring groove with a piston ring and a feeler gauge

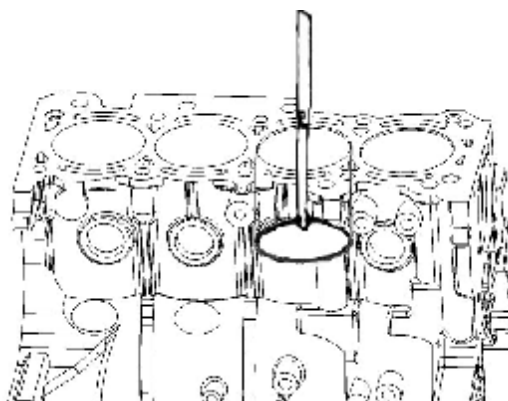
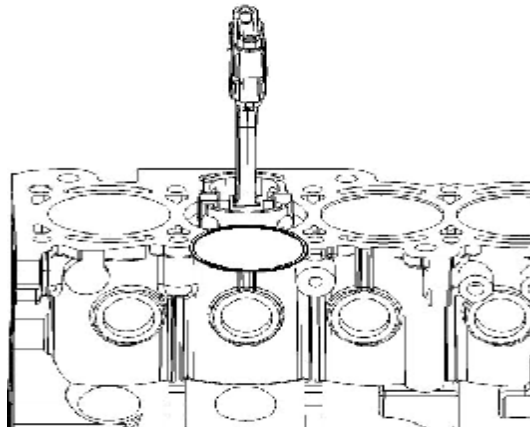
	Standard value (mm)	Limit (mm)
First ring	0.03~0.06	0.12
Second ring	0.03~0.06	0.11



4.2.6 Inspect the end clearance of piston ring

4.2.6.1 Put the piston ring 45mm below the top surface of the cylinder hole. Press down the piston ring with the piston head, and then measure the opening with a feeler gauge.

	Standard value (mm)	Limit (mm)
First ring	0.25-0.40	0.65
Second ring	0.35~0.50	0.65
Oil ring	0.20~0.70	1.00



4.2.7 Inspect the clearance between the piston and cylinder wall

4.2.7.1 Measure the inner diameter of the cylinder and the outer diameter of the piston at the positions as indicated in the right figure. If the measurement results exceed the limit, replace the piston or cylinder.

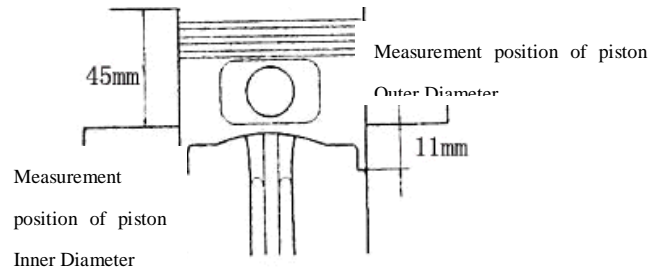
Standard value: 0.018~0.030

Limit: 0.10

[Reference] The clearance between the piston and cylinder bore is controlled by the difference between the minimum inside diameter of piston hole and the maximum outer diameter of piston.

4.2.7.2 After replacing the piston or the cylinder body, confirm the clearance again

Standard value: 0.018~0.030



4.3 Crankshaft

4.3.1 Inspect the proper alignment of the main axle diameter.

4.3.1.1 Measure the proper alignment with a dial gauge, if the proper alignment is beyond the limit, replace the crankshaft.

Limit: 0.03mm

Notice: The bending value should be equal to one-second the run-out value of crankshaft rotating one circle.

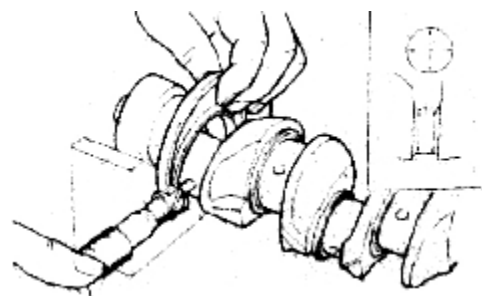
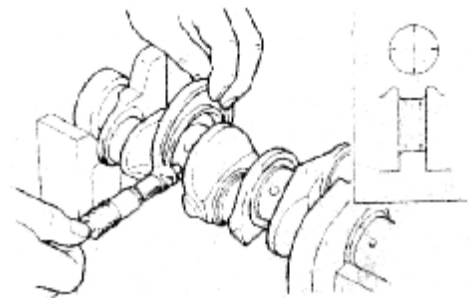
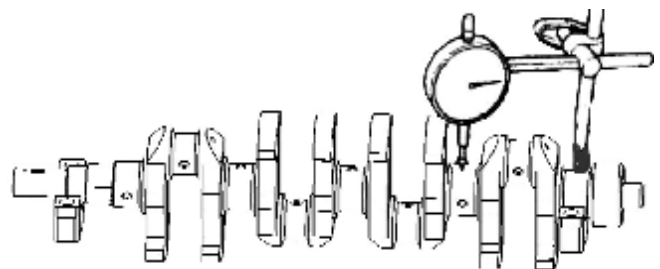
4.3.2 Inspect the crankshaft for the abrasion.

4.3.2.1 Measure the connecting rod journal at the positions indicated in the left figure with a microcaliper, and figure out the roundness and cylindricity.

Limit: 0.005mm

4.3.2.2 Measure the connecting rod journal at the positions indicated in the right figure with a microcaliper, and figure out the roundness and cylindricity.

Limit: 0.004mm

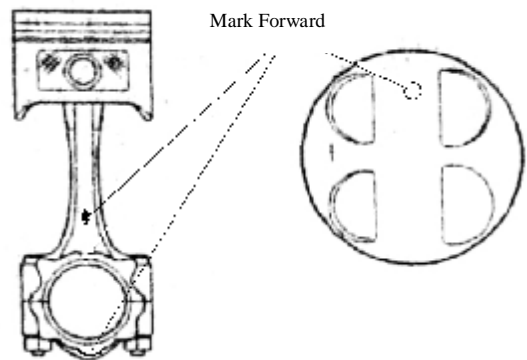


5 Assembly of Crank Connecting Rod mechanism

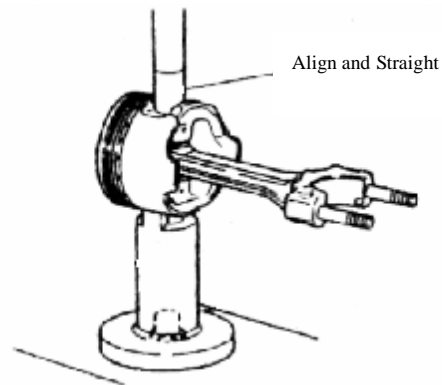
5.1 Assembly of the piston connecting rod

5.1.1 Assemble the piston, connecting rod and the piston pin with special tool following the instructions below:

5.1.1.1 Spread engine oil over the pin hole of the connecting rod, assemble according to the group mark and direction mark of piston and connecting rod.



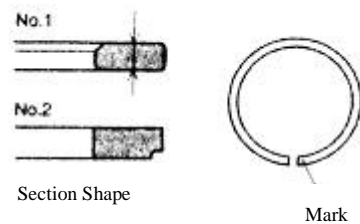
5.1.1.2 Assemble the piston and the connecting rod with special tools shown in the right figure.



5.1.1.3 Adjust and assemble the piston and connecting rod as indicated in the right figure. Spread the piston pin with oil and then assemble the piston and connecting rod with a pressing machine.

Notice: When pressing in the piston pin, make sure the fitting direction is correct.

When the piston pin is pressed into the piston, the small end of the connecting rod should be heated to 300°C, and the pin should be aligned properly.

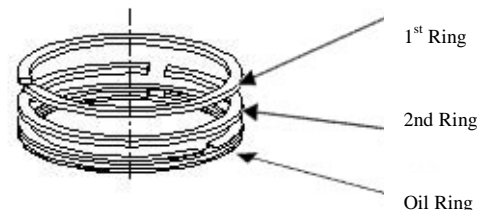


5.2 Install the first and second piston ring and the oil ring according to the following instruction:

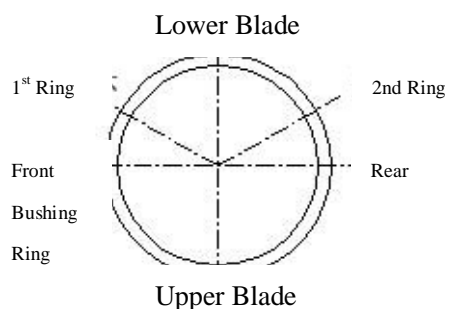
5.2.1 Installation of piston ring

Make the side with marks face upwards, and then fix it with piston pin tools.

0



5.2.2 Mount the steel tape combined oil ring (bushing ring lower, lower blade, upper blade) firstly, and then mount the second gas ring, and finally mount the first gas ring. Opening angles of rings are shown in the figure:



5.3 Resemble the crankshaft main bearing cap, crankshaft, crankshaft bearing bushing and the crankshaft axial thrust plate, pay attention to the following:

5.3.1 Assembling the bearing bushing, its raised thrust block should fit into the locating groove in the cylinder body.

Notice: The bearing bushing is from the same manufacturer.

5.3.2 Spread the crankshaft bearing bushing (upper piece) with oil before assemble the crankshaft

5.3.3 Mount the thrust plate on the cylinder body bearing base and make sure that the side with oil groove (crankshaft shank) face outwards.

Notice: Spread the side of oil groove with oil

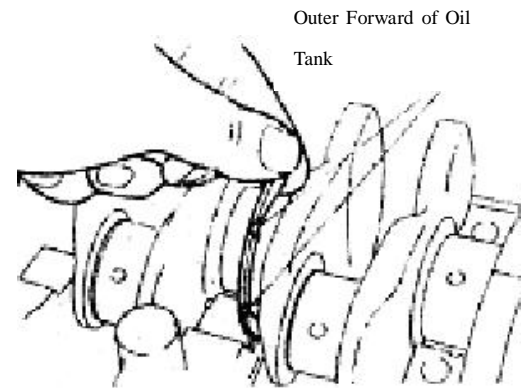
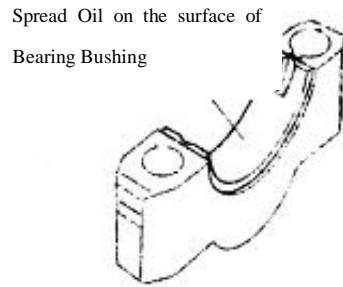
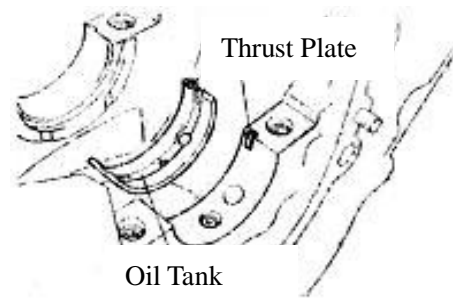
5.3.4 Fix the crankshaft bearing bushing (lower piece) in the bearing cap, the bearing bushing should fit into the thrust groove.

5.3.5 Spread engine oil over the friction surface of crankshaft bearing bushing (lower piece), assemble the bushing according to the mark forwards in the main bearing cap of the crankshaft.

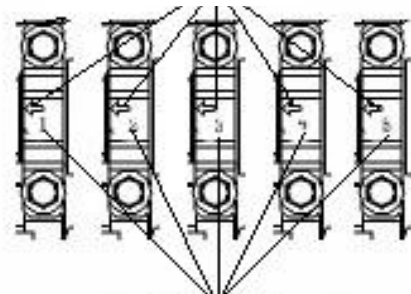
5.3.6 Spread oil over the bolts, within three or two times, tighten them with specified torque.

Torque: $70 \pm 3.5 \text{N.m}$

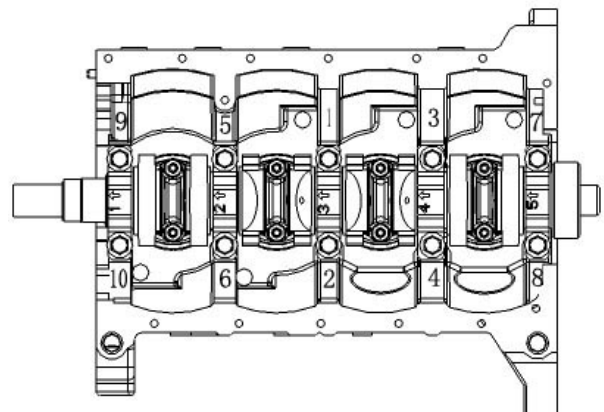
5.3.7 Rotate the crankshaft after assembly, it should rotates swiftly, the rotating torque should be less than 1Nm.



Forward Mark



Axle Diameter Mark



5.4 Assemble the piston and connecting rod assembly, connecting rod bearing bushing and the connecting rod bearing cap, pay attention to the following:

5.4.1 The opening of compression ring and the opening of oil ring should be in the specified direction.

5.4.2 The bolts of the connecting rod should be covered with nylon sleeves for fear of scraping the cylinder body and the axle.

5.4.3 The surfaces of piston and connecting rod and other surfaces where relative motion exists should be spread with engine oil.

5.4.4 Confirm the mark forwards of the piston and strike it into the cylinder body with the piston ring striking tool.

Notice: The cylinder number of the piston and connecting rod assembly should be in accordance with the cylinder number.

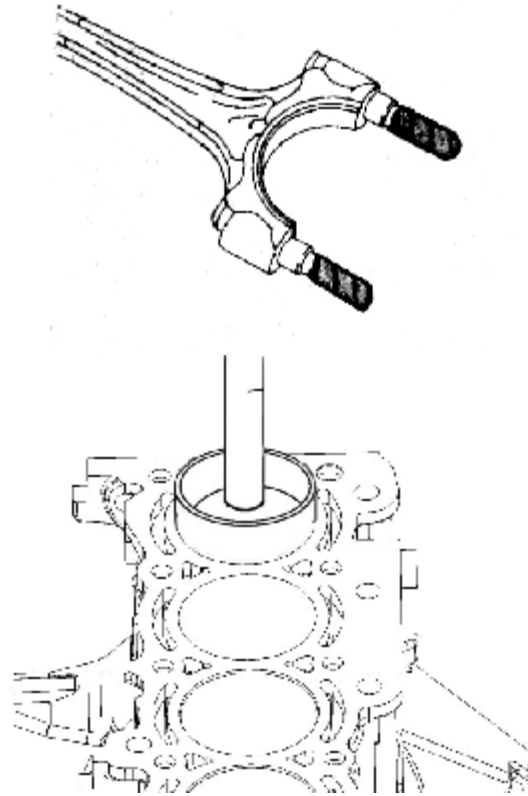
5.4.5 Assemble the connecting rod bearing cap and the connecting rod bushing, pay attention to the following:

5.4.5.1 Put the cover on the bolt as per the mark forwards, spread a little engine oil over the joint surface between the nut and its seat.

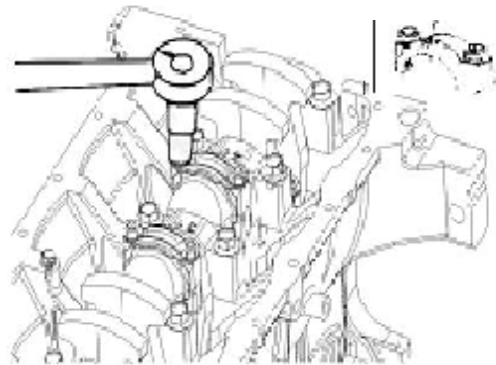
5.4.5.2 Tighten the right nut and the left nut alternatively for several times with specified torque.

Torque: $40 \pm 2 \text{N.m}$

Notice: The connecting rod and the connecting rod bushing should be of the same subassembly:



Forward Mark



Chapter 3. Table of Main Fit Clearance for SQR472 Engine SQR472

1 Clearance between Cylinder Hole and Piston Skirt (Piston to Cylinder Clearance)

Name of Component		Size and Tolerance	Clearance or Value of Interferenc	Remark
	Cylinder hole	$\phi 72^{+0.01}_0$	Divided into two groups: Clearance for group X: 0.019mm~0.03mm Clearance of group S: 0.018mm~0.029mm	Group X: $F72^{0.005}_0$
	Piston skirt	$\phi 72^{-0.015}_{-0.025}$		Group S: $F72^{0.01}_{0.005}$

2 Clearance of Crankshaft Main Bearing

Name of Component		Size and Tolerance	Clearance or Value of Interferenc	Remark
	Crankshaft main journal	$\phi 42h_6-0-016$	Clearance 0.025~0.069	
	Bearing bushing	$2^0_{-0.006}$		
	Bore of cylinder main bearing	$\phi 46F_6^{+0.041}_{+0.025}$		

3 Clearance of Crankshaft Connecting Rod Bearing

Name of Component		Size and Tolerance	Clearance or Value of Interferenc	Remark
	Crankshaft connecting rod journal	$\phi 37h_6^0_{-0.016}$	Clearance 0.025~0.069	
	Bearing bushing	$1.5^0_{-0.006}$		
	Bore of connecting rod big end bearing	$\phi 40F_6^{+0.041}_{+0.025}$		

4 Clearance between Piston Pin and Piston Pin Hole

Name of Component		Size and Tolerance	Clearance or Value of Interferenc	Remark
	Piston Pin Hole	$\phi 18^{+0.007}_{+0.002}$	Divided into twogroups Clearance for group A: 0.004 mm~0.0085mm; Clearance for group B: 0.0045mm~0.009 mm	Notice: When installed with hand, the piston pin may pass through the piston pin hole smoothly without any obvious obstruction, otherwise the piston pin should be replaced.
	Piston pin	$\phi 18^{-0.001}_{-0.004}$		

5 Inteference between Piston and Small End of Connecting Rod

Name of Component		Size and Tolerance	Clearance or Value of Interferenc	Remark
	Connecting rod small end hole	$\phi 18^{-0.026}_{-0.044}$	Value of Interferenc 0.021~0.043	

	Piston Pin	$\phi 18 \begin{matrix} -0.001 \\ -0.005 \end{matrix}$	
--	------------	--	--

6 Fit Clearance between Connecting Rod Body Hole and Bolt Bar

Name of Component	Size and Tolerance	Clearance or Value of Interferenc	Remark
Connecting rod body hole	$\phi 8.08 H_7^0 \begin{matrix} +0.015 \\ \end{matrix}$	Value of Interferenc 0.008~0.032	The hole should be processed along with the connecting rod body.
Bolt Bar	$\phi 8.08 S_6 \begin{matrix} +0.032 \\ +0.023 \end{matrix}$		

7 Fit Clearance between Connecting Rod Cover Hole and Bolt Bar

Name of Component	Size and Tolerance	Clearance or Value of Interferenc	Remark
Connecting rod cover hole	$\phi 8.08 H_7^0 \begin{matrix} +0.015 \\ \end{matrix}$	Clearance 0.005~0.029	The hole should be processed along with the connecting rod body.
Bolt bar	$\phi 8.08 f_6 \begin{matrix} -0.005 \\ -0.014 \end{matrix}$		

8 Radial Clearance of Camshaft Bearing

Name of Component	Size and Tolerance	Clearance or Value of Interferenc	Remark
Intake	Cylinder Head	Clearance 0.020~0.054	1 st bearing cap
	Camshaft		1 st bearing cap
	Cylinder Head	Clearance 0.020~0.054	2 nd , 3 rd , 4 th & 5 th bearing caps
	Camshaft		2 nd , 3 rd , 4 th & 5 th bearing caps
Exhaust	Cylinder Head	Clearance 0.020~0.054	1 st bearing cap
	Camshaft		1 st bearing cap
	Cylinder Head	Clearance 0.020~0.054	2 nd , 3 rd , 4 th & 5 th bearing caps
	Camshaft		2 nd , 3 rd , 4 th & 5 th bearing caps

9 Fit Clearance between Tappet Hole and Tappet

Name of Component	Size and Tolerance	Clearance or Value of Interferenc	Remark
Cylinder Head Hole	$\phi 28H_7^0 \begin{matrix} 0.021 \\ \end{matrix}$	Clearance 0.020~0.054	
Tappet	$\phi 28f_6 \begin{matrix} -0.020 \\ -0.033 \end{matrix}$		

Remarks: In the above tables, the capital letter and suffix following the sizes (For example, H₇ of φ28H₇) mean the process precision, which are unconcerned with the maintenance and may be ignored in the course of maintenance.

Chapter 4. Table of Measurement Parameters of SQR472 EngineSQR472

No.	Measuring Items	Acceptance value	Remark
1	Axial clearance of crankshaft	0.089-0.211mm	
2	Torque of crankshaft when rotating at uniform speed	Assemble the crankshaft and tighten the main bearing cap bolt	≤1 Nm
		Mount the piston connecting rod assembly and tighten the connecting rod bolt	≤5.5Nm
			≤6Nm
		Installing timing belt and spark plug	≤26 Nm
	Mount the valve, spring and camshaft (excluding timing belt and spark plug) on the cylinder head, tighten the camshaft bolt, and then measure the torque of the camshaft rotating at uniform speed	≤32 Nm	
3	Distance between the outer edge of steel ball and the front end of camshaft	5.65±0.5mm	
4	Distance between the outer edge of steel ball and the rear end of camshaft	8.65±0.5mm	
5	Axial clearance of intake camshaft	0.10~0.179	
6	Axial clearance of exhaust camshaft	0.10~0.253	
7	Jumping amount of installation surface of flywheel wearing piece	0.10mm _{max}	
8	Protrusion height of crankshaft woodruff key	2~2.20mm	
9	Intake valve clearance	0.18±0.05mm	
10	Exhaust valve clearance	0.25±0.05mm	
11	Tension of timing belt (When the middle part of the right side is pressed down for 4-5mm)	200~280N.m	
12	Compression pressure of cylinder	10~14bar	
13	Tension of generator belt (When the part between the generator and water pump is pressed down for 4-5mm)	98N.m	
14	Refilling amount of engine oil (including filter)	3.5 Liter	

Chapter 5. Table of Main Fitting Torque for SQR472 EngineSQR472

No.	Name	Specification	Quantity	Fixing Torque (Nm)	Remark
1	Main bearing cap bolt	M10X1.25	10	70±3.5	
2	Connecting rod cover bolt	M8X1	8	40±2	
3	Oil pump bolt	M8X1	6	20±1.5	
4	Nut (oil collector – oil ppump)	M6	2	6±1	
5	Bolt (oil collector – cylinder body)	M6	1	6±1	
6	Water pump bolt	M8X1	6	25±1.5	
7	Rear oil seal bracket bolt	M8	5	25±1.5	
8	Drain plug	M12	1	45±3	
9	Oil pan bolt	M6	19	6±1	
10	Bolt connecting exhaust camshaft with flange (hexagonal)	M6	4	6±1	
11	Exhaust camshaft locking nut	M40X1.5(L)	1	100±5	
12	Cylinder head bolt	M10X1.25	10	70±3.5	
13	Camshaft bearing cap bolt	M6	19	9±1	
14	Cylinder head chamber cover bolt	M6	8	4.5±0.5	
15	Camshaft position sensor bolt	M8	1	10±1	
16	Bolt (knock sensor)	M8	1	20±1.5	
17	Camshaft timing gear bolt	M12X1.25	1	100±5	
18	Tension pulley bolt	M10	1	25±3	
19	Timing cover bolt	M6	7	6±1	
20	Engine oil gauge pipe bolt	M6		6±1	
21	Flywheel assembly bolt	M10X1.25	6	70±3.5	
22	Thermoregulator shell bolt	M8	2	10±1	
23	Oil filter conncector	3/4"-16		40±2.5	
24	Oil filter	3/4"-16		20±1.5	

25	Intake/exhaust stud	M8	16	10±1	Spread glue
26	Intake pipe nut	M8	8	25±1.5	
27	Ignition coil bracket assembly bolt	M8	2	20±1.5	
28	Front lifting lug bolt	M8	2	20±1.5	
29	Exhaust pipe nut	M8	8	25±1.5	
30	Exhaust pipe thermal shroud bolt	M6	3	6±1	
31	Bolt on crankshaft pulley & torsional damper assembly	M12X1.25	1	100±5	
32	Water pump pulley bolt	M6	4	6±1	
33	Water temperature sensor	M12X1.5	1	15±1.5	
34	Oil pressure switch		1	30±2	
35	Spark plug	M14X1.25	4	20±1	
36	Fixing Bolt of spark plug cover board)	M6	8	2.5±0.5	
37	Bolt (intake pipe front bracket)	M8	1	20±1.5	
38	Bolt (intake pipe rear bracket)	M8	4	20±1.5	
39	Bolt (throttle cable)	M6	2	6±1	
40	Bolt (gas-oil separator bracket)	M6	2	6±1	
41	Bolt (throttle valve casing)	M6	4	6±1	
42	Oxygen sensor	M18X1.5	1	40±2	
43	Bolt (intake temperature & pressure sensor)	M4	1	3±1	
44	Fixing bolt of fuel guide rail	M6	2	7±1	
45	Ignition coil bolt	M6	3	5±1	

Chapter 6. Positions on SQR472 Engine to be Lubricated

Type of lubricating oil: Engine lubricating oil

Designation of lubricating oil: SAE10W/30-50(SF Class)

No.	Position to be lubricated	Remark
1	Joint surface of connectong rod bolt head	
2	Screw of connecting rod bolt	
3	Excircle of piston pin	
4	Inner wall of piston pin hole	
5	Piston and piston ring	
6	Inner wall of cylinder hole	
7	Crankshaft main neck	
8	Connecting rod shaft neck	
9	Upper & lower main bearing bushing (inside)	
10	Upper & lower connecting rod bearing bushing (inside)	
11	Crankshaft thrust plate (the side of oil gloove)	
12	Front oil seal and crankshaft front oil seal journal	
13	Rear oil seal and crankshaft rear oil seal journal	
14	Valve seat hole	
15	Valve tappet and valve pipe hole	
16	Excircle and hole of valve tappet	
17	Camshaft journal and bearing base hole	
18	Camshaft driving gear	
19	Edge and excircle of oil seal	
20	Oil seal journal and oil seal base hole	
21	Surface oil filter sealing gasket	

Chapter 7. Positions on SQR472 Engine to be Spread with Sealant

SQR472

No.	Position to be spread with sealant	Type of sealant	Form and amount of sealant (reference)	Remark
1	Joint surface of oil pan	Loctite 5699	$\phi(3\sim 4)\text{mm}$	
2	Rear oil seal bracket	Loctite 5699	$\phi(3\sim 4)\text{mm}$	
3	Valve chamber cover	Loctite 5699	$\phi(3\sim 4)\text{mm}$	
4	Joint surface of timing gear chamber cover	Loctite 5699	$\phi(3\sim 4)\text{mm}$	
5	Joint surface of camshaft cover	Loctite 5699	$\phi(3\sim 4)\text{mm}$	
6	Sealing surface of the bowl shaped plug of cylinder head	Loctite 11747	Spread uniformly	
7	Flywheel bolt	Loctite 204	$0.125(\text{ml})\times 6$	Pre-spread @3
8	Intake pipe stud	Loctite 262	$0.125(\text{ml})\times 7$	The part screwed into the cylinder head
9	Exhaust pipe stud	Loctite 262	$0.125(\text{ml})\times 6$	The part screwed into the cylinder head
10	Camshaft timing gear bolt	Loctite 243	0.2ml	
11	Oil collector stud	Loctite 243	$0.08(\text{ml})\times 2$	The part screwed into the oil pump
12	Screw of thermoregulator shell fixing bolt	Loctite 243	$0.08(\text{ml})\times 2$	The part screwed into the cylinder head