MECHANISM OF 2.0NA ENGINE

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CHAPTER 1 ENGINE PARAMETER AND SPECIAL MAINTENANCE TOOLS

SECTION 1 TECHNOLOGY DATA INSTRUCTION

ENGINE CHARACTER

Engine Model		SQR481H
Engine Type		4-Cylinder, Water Cooled, In-line Double Overhead Camshaft, 16 Valve, Controllable Burning Rate, Variable Valve Timing
Cylinder Diameter（mm）		83.5
Piston Stroke (mm)		90
Displacement (L)		1.971
Compression Ratio		10
Rated Power（Kw）		95
Rev at Rated Power（r/min）		5500
Max. Torque（N●M）		180
Rev at Max. Torque（r/mim）		4000
Minimum Fuel Consumption Rate（g/Kw.h）		301
Cylinder Pressure（Bar）		10±0.2
Fuel Pressure（Bar）		4
Engine Oil Pressure（Bar）	Low Idle Speed（800±50r/min）	
	High Idle Speed（2000r/min）	
	High Speed（4000r/min）	
A/C Circuit Pressure（Bar）	High Pressure Circuit	2--3
	Low Pressure Circuit	12---16
Expansion Tank Cap（kpa）	Pressure Relief Valve（Release Pressure to Outside）	88±14.5
	Vacuum Valve（Lead Air into Tank）	-10~~~~-2
Thermostat Working Temperature（℃）	Start Working Temperature	87
	Full Working Temperature	104

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TECHNOLOGY DATA INSTRUCTION

Item			Standard Value
Camshaft	Cam Height	Intake cam	37.15
		Exhaust cam	37.05
	Camshaft Diameter	Intake cam	$24^{-0.040}_{-0.053}$
		Exhaust cam	$24^{-0.040}_{-0.053}$
	Axial clearance of Camshaft	Intake cam	0.15--0.20
		Exhaust cam	0.15--0.20
Cylinder Head	Plane Degree of Lower Surface		0.04
	Whole Height		140±0.41
	Surface Grind Limit* Total Grinding Quantity of Cylinder Block and Head		
Valve	Fringe Thickness on Top of Valve	Intake Valve	0.3±0.15
		Exhaust Valve	0.3±0.15
	Valve Stem Diameter	Intake Valve	5.98±0.008
		Exhaust Valve	5.96±0.008
	Seal Bandwidth	Intake Valve	
		Exhaust Valve	
	Gap Between Valve Stem And Guide	Intake Valve	0.02
		Exhaust Valve	0.04
	Tilt Angle	Intake Valve	65°
		Exhaust Valve	68°
	Height	Intake Valve	107.998
		Exhaust Valve	106.318
Valve Spring	Free Height		47.7
	Working Tension in Advance/ Working Height Kg /mm		620N/32mm
	Vertical Degree		
Valve Guide	Valve Guide Length		38±0.25
	Inside Diameter		5.4±0.1

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	Outer Diameter		$11^{+0.051}_{+0.040}$
	Pressure Height		16±0.3
	Protruding Part of Valve Stem		47.5
Piston	Piston Skirt Diameter		83.46±0.009
Piston Ring	Side Clearance	1st Ring	0.04--0.08
		2nd Ring	0.01--0.025
	End Play	1st Ring	0.2--0.4
		2nd Ring	0.4--0.6
	Height	1st Ring	$1.2^{+0.05}_{+0.03}$
		2nd Ring	$1.5^{+0.04}_{+0.02}$
		Oil Ring	$2.5^{+0.03}_{+0.01}$
Ring Groove	Height/ Depth	1st Ring	$1.2^{-0.01}_{-0.03}$
		2nd Ring	$1.5^{-0.005}_{-0.030}$
		Oil Ring	2.5
Piston Pin	Diameter		$21^{0}_{-0.005}$
	Length		60
	Diameter of Piston Pin Hole		$21^{0.008}_{0.002}$
Crankshaft	Axial Clearance		0.076--0.265
	Radical Clearance		-0.0375
	Crankshaft Mainshaft Diameter	Coaxial Degree	0.05
		Cylindricity	0.008
		Roundness	0.005
	Connecting Rod Journal Diameter	Cylindricity	
		Roundness	
Cylinder	Whole Height		218±0.05
	Cylinder Hole Roundness / Straightness Accuracy		0.008 / 0.01
	Upper Surface Planeness		0.04
Connecting Rod	Radial Clearance of Connecting Rod Bearing		0.016--0.051
	Axial Clearance of Big End		0.15--0.4

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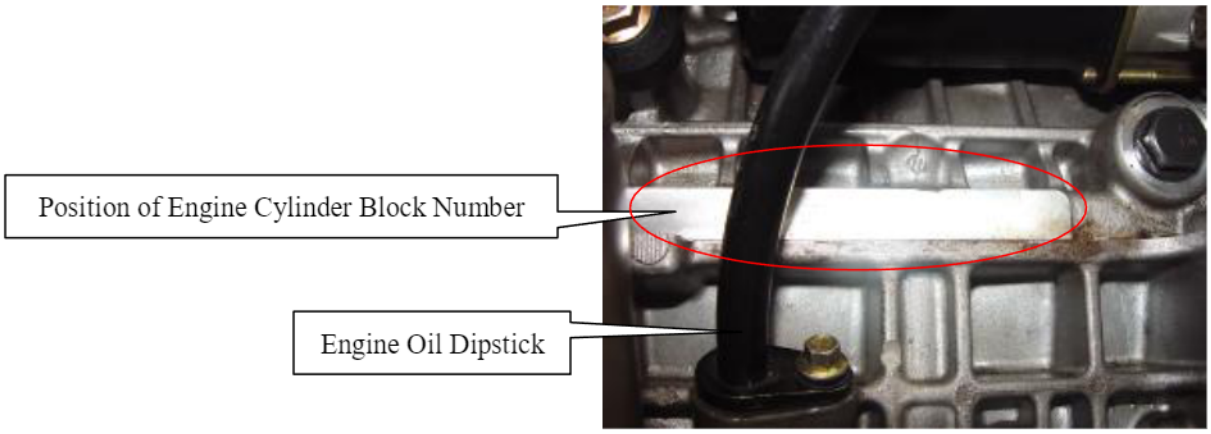
SECTION 2 SPECIAL TOOLS

	Camshaft Timing Tool
	Crankshaft Timing Tool
	Flywheel Tool
	Guide Sleeve of Crankshaft Oil Seal
	Guide Sleeve of Camshaft Oil Seal
	Hydraulic Hoist

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	Fuel Pressure Gauge
	Cylinder Pressure Gauge: when measure the cylinder pressure, firstly remove the spark plug, screw the pipe end of instrument instead of it, and operate the engine by starter, then take the maximum value in cylinder pressure gauge as cylinder pressure.

SECTION 3 ENGINE NUMBER POSITION



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SECTION 4 COLLATING METHOD OF ENGINE TIMING

1. Remove the upper cover of engine timing belt.



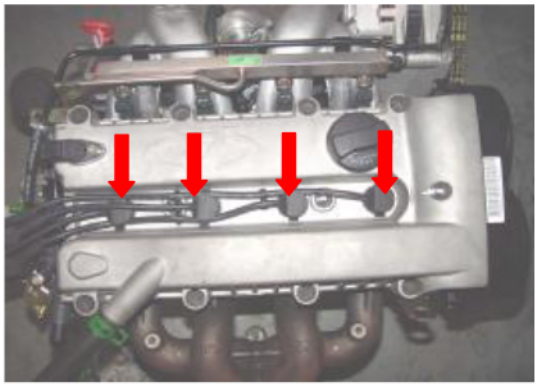
2. Remove the lower cover of engine timing belt.



3. Loosen the central bolt of timing belt tension pulley and remove the timing belt.

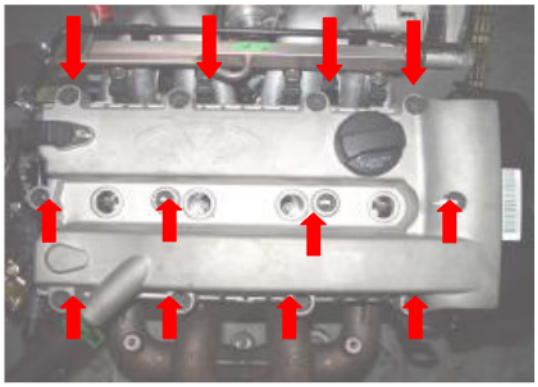


4. Draw out the high voltage ignition cable.

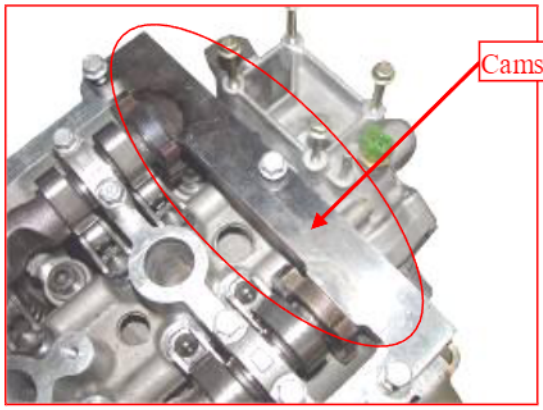


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5. Loosen the bolt of valve cover and remove the valve cover.

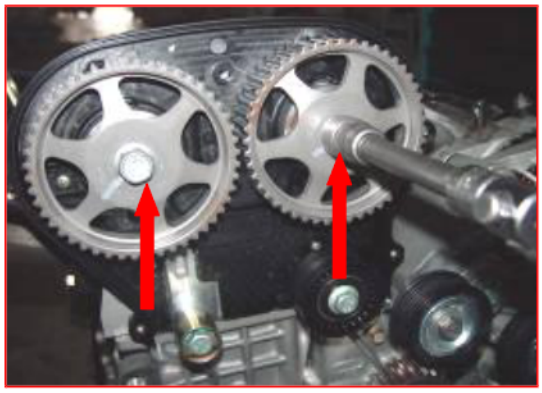


6. Rotate the camshaft in order to clip the camshaft tool into the slot at the end of camshaft.



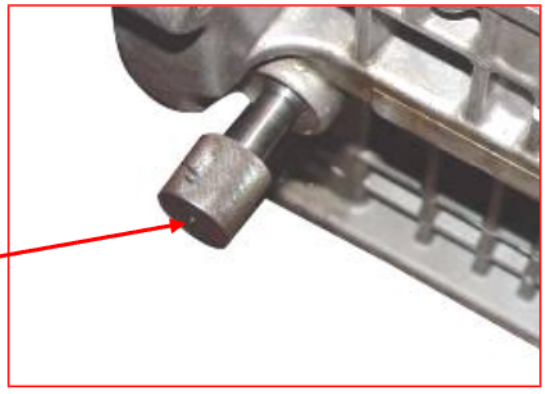
7. Loosen the bolts of air intake and exhaust camshaft tension pulleys with torque wrench.

Note: It is not to remove but loosen.



8. Revolving the crankshaft, you may rotate in the crankshaft tool so as to it cannot move in both direction.

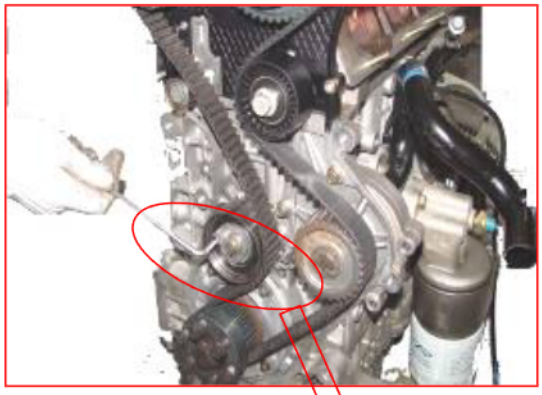
Note: Do it with patience and carefulness lest the crankshaft should be broken.

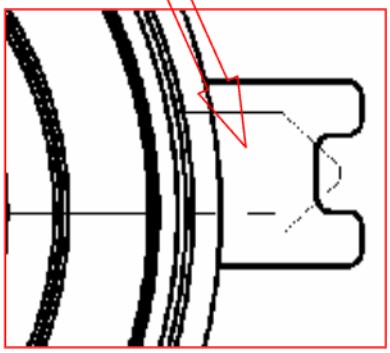


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9. Mount the timing belt and rotate tension pulley with Allen wrench in order to tension the belt and make the finger of tensioner point to the middle of U slot opening. Fasten the bolt of tension pulley, the fastening bolts of air intake and exhaust camshaft tension pulleys and camshaft.

Torque: 120±5Nm.



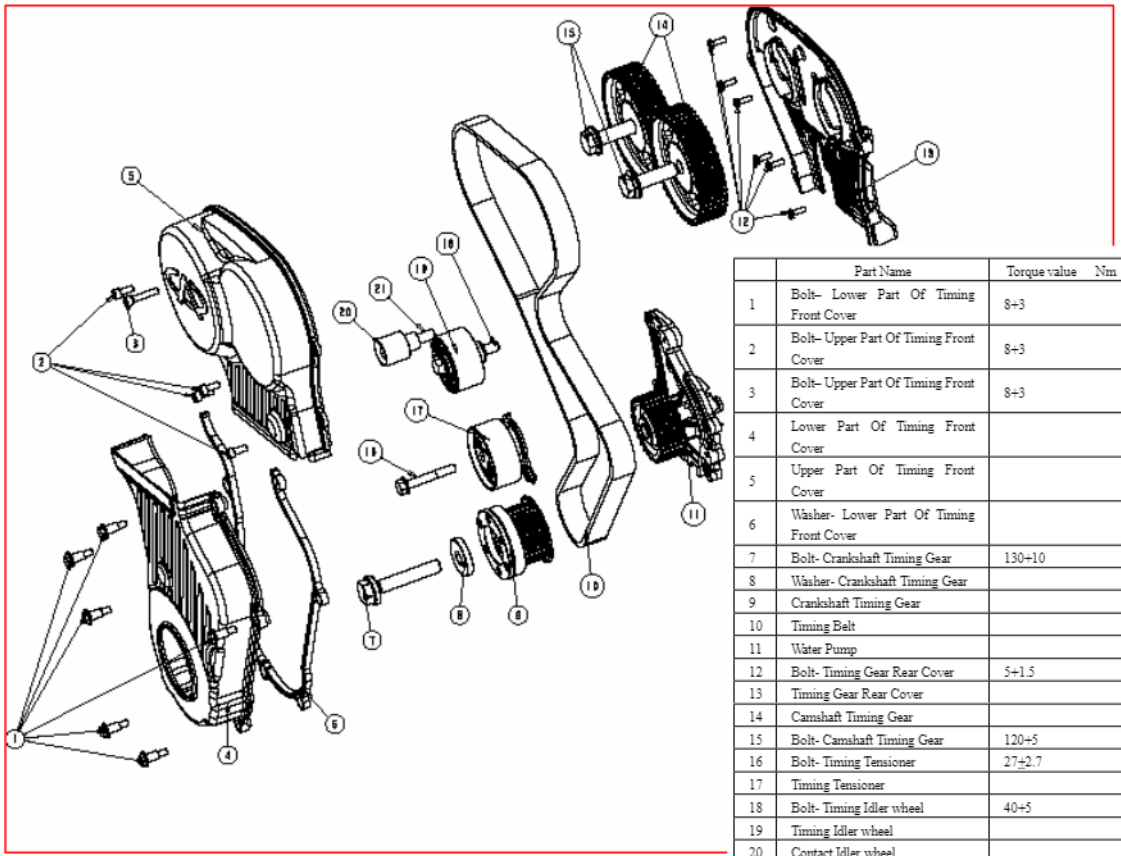


10. Remove the special timing tool, and mount the valve cover, the high voltage ignition cable and the timing belt cover.

CHAPTER 2 ENGINE BODY

SECTION 1 WHEEL TRAIN

I. STRUCTURAL DIAGRAM



	Part Name	Torque value Nm	Re-screw angle
1	Bolt– Lower Part Of Timing Front Cover	8+3	
2	Bolt– Upper Part Of Timing Front Cover	8+3	
3	Bolt– Upper Part Of Timing Front Cover	8+3	
4	Lower Part Of Timing Front Cover		
5	Upper Part Of Timing Front Cover		
6	Washer- Lower Part Of Timing Front Cover		
7	Bolt- Crankshaft Timing Gear	130+10	65+5
8	Washer- Crankshaft Timing Gear		
9	Crankshaft Timing Gear		
10	Timing Belt		
11	Water Pump		
12	Bolt- Timing Gear Rear Cover	5+1.5	
13	Timing Gear Rear Cover		
14	Camshaft Timing Gear		
15	Bolt- Camshaft Timing Gear	120+5	
16	Bolt- Timing Tensioner	27±2.7	
17	Timing Tensioner		
18	Bolt- Timing Idler wheel	40+5	
19	Timing Idler wheel		
20	Contact Idler wheel		
21	Bolt- Contact Idler wheel	40+5	

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II. MAINTENANCE

1. Replace upper and lower covers of timing belt

1.1 Needed tools and auxiliary materials

Allen wrench, 10#, 13# sleeve, ratchet wheel and ratchet rod.

1.2 Removal

1) Loosen the five bolts on the upper cover with Allen wrench.

2) Remove the upper cover of timing belt.



3) Clip the flywheel with flywheel tool.

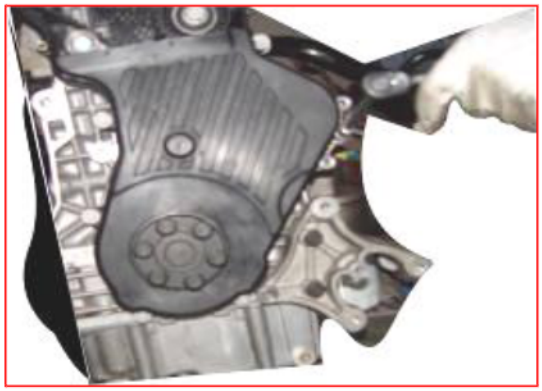


4) Remove the crankshaft pulley with 13# sleeve.



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5) Remove the 5 bolts on the lower cover of timing belt with 10# sleeve, ratchet wheel and ratchet rod.



6) Remove the lower cover.



1.3 Inspection

Observe the timing cover and the timing belt. Replace the timing belt cover or adjust the position of timing belt if any trail from crack or friction is found.

1.4 Installation

The installing steps are reverse to those for removal.

Note: Install the lower cover first and then install the upper one.

2. Replace timing belt

2.1 Needed tools and auxiliary materials

Allen wrench, 10#, 13# sleeve, ratchet wheel and ratchet rod.

2.2 Removal

1) Remove the upper and lower covers of timing belt (see "replace covers of

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timing belt" for details).

2) Loosen the central bolt of tension pulley and remove the timing belt.

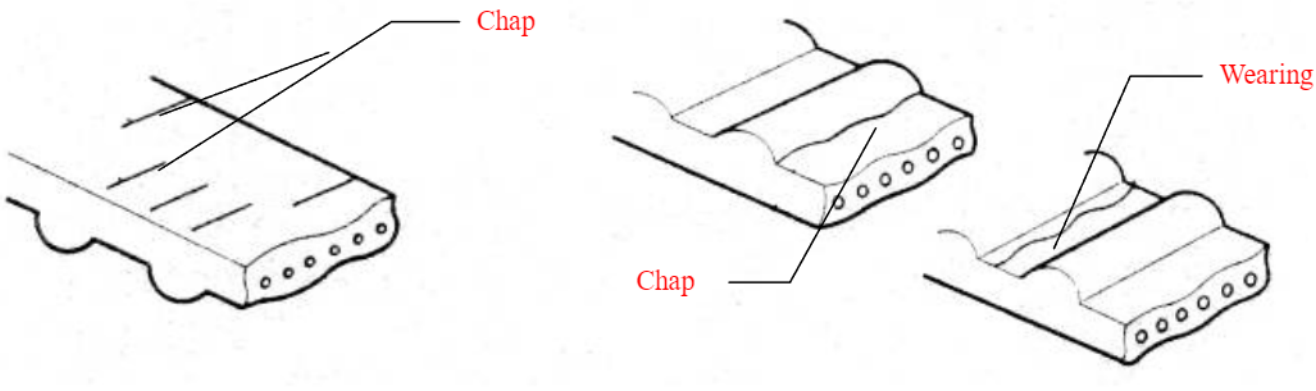
2.3 Inspection

Check the timing belt carefully; replace the parts if any following situation occurs.

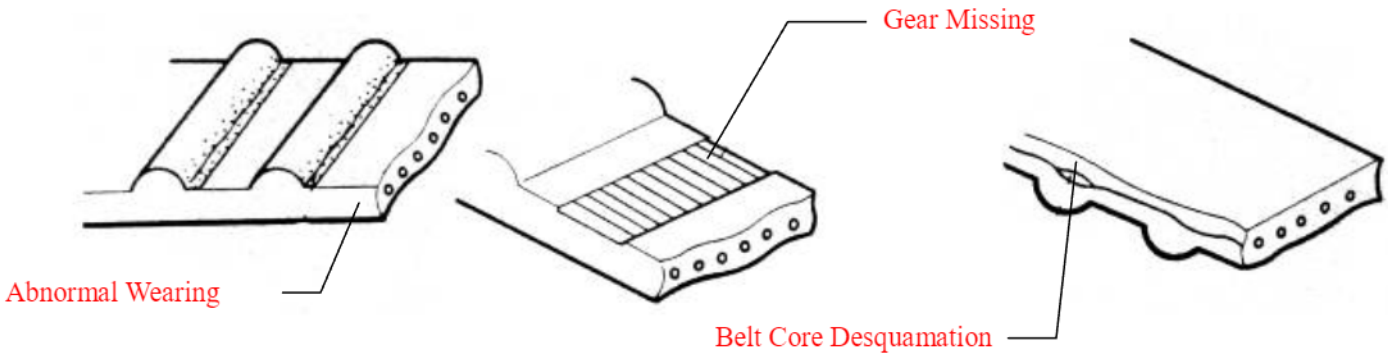
(1) Chap of back-side rubber

(2) Chap of dedendum, chap of separated cord fabric.

(3) Wearing, gear missing and incomplete gear of cord fabric.



(4) Abnormal wearing of belt flank.



Replace the belt as any following situation occurs, even though abrasion cannot be found directly.

1) The water pump leaks water out, and requires continuing infusion.

2) If the belt is spotted with much oil stains, and the rubber may be damaged due to expansion, you should replace the belt.

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2.4 Installation

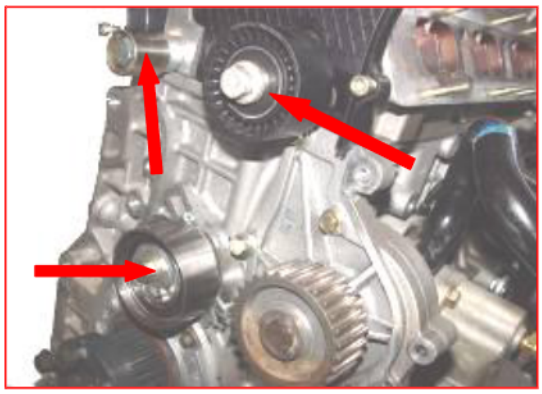
The installing steps are reverse to those for removal.

Note: Do engine timing.

3. Replace idler wheel, tensioner and contact belt pulley

3.1 Needed tools and auxiliary materials

Allen wrench, 10#, 13# and 15# sleeve, ratchet wheel and ratchet rod.



3.2 Removal

1) Remove the timing belt (see "replace timing belt" for details).

2) Remove idler wheel, tension pulley and contact belt pulley.

3.3 Inspection

1) Check from appearance

Check idler wheel, tension pulley and contact belt pulley carefully for any damages, such as sunken trace and sliding damage etc.

2) Check performance

Revolve tension pulley, idler wheel and contact belt pulley respectively to insure that they can run freely without stagnancy.

Replace it with the spare part if any above problem is found.

3.4 Installation

1) The installing steps of tension pulley, idler wheel and contact belt pulley are reverse to those for removal.

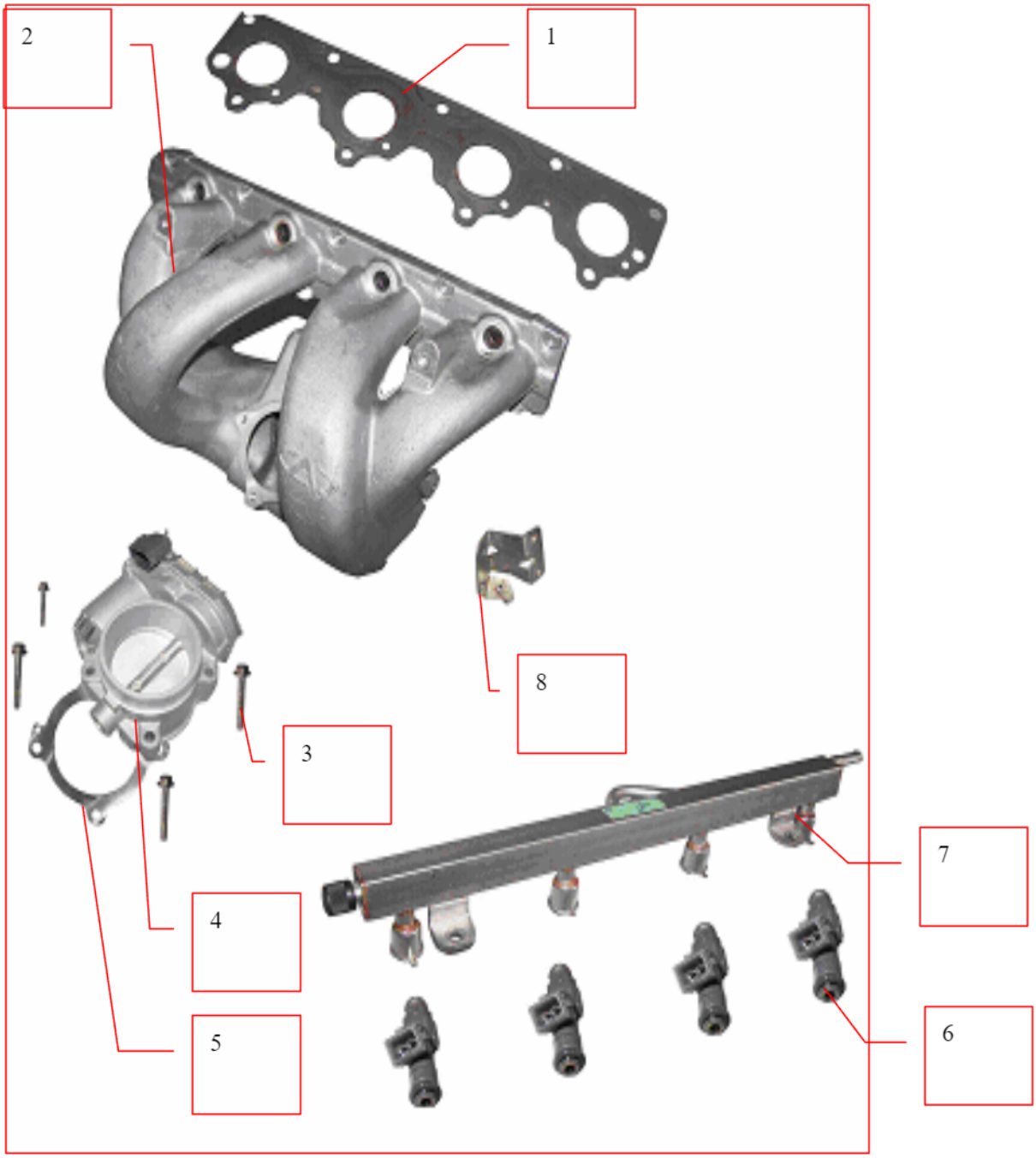
2) Mount the timing belt and collate engine timing.

3) Mount other parts.

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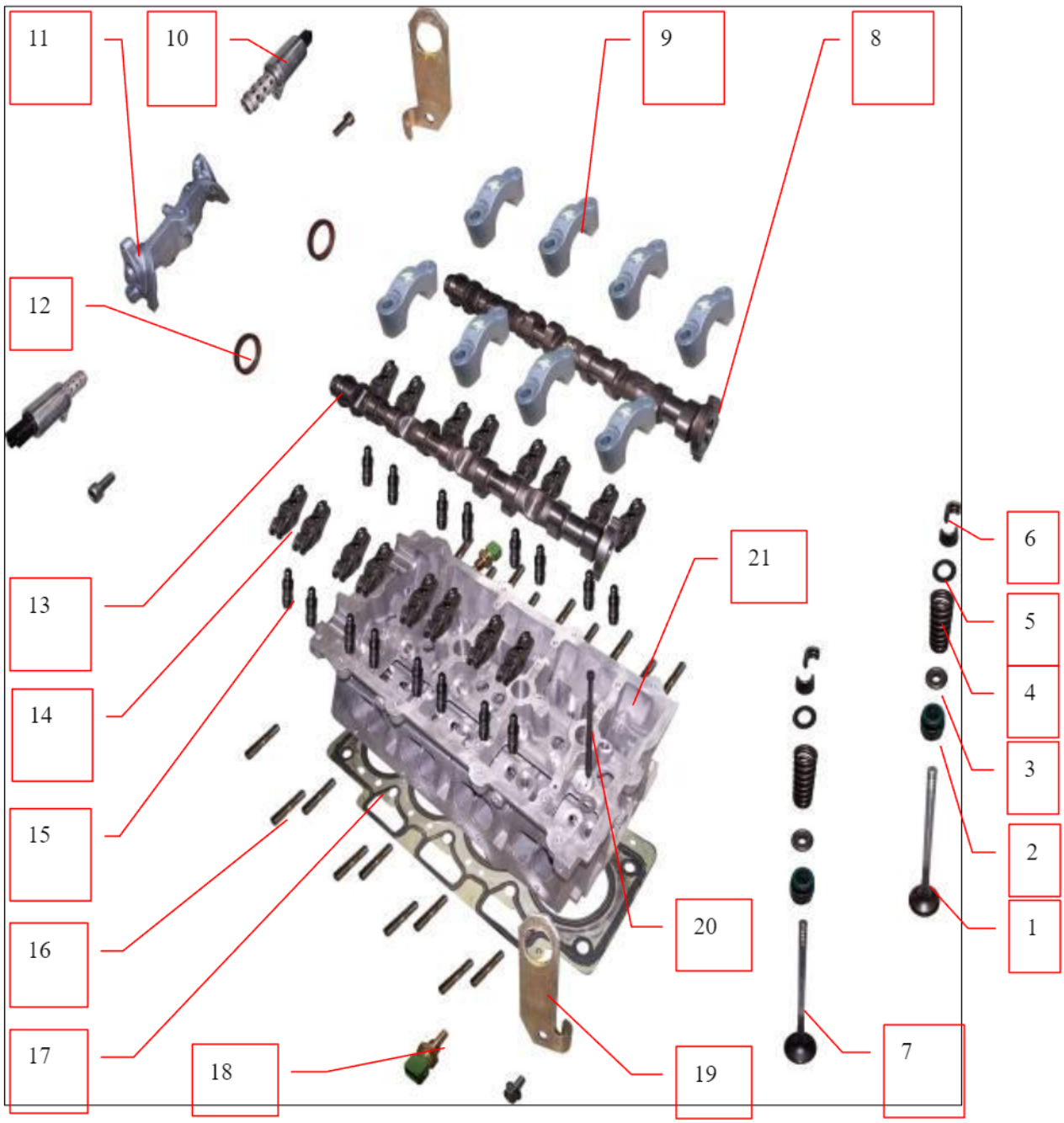
SECTION 2 CYLINDER HEAD

I. STRUCTURAL DIAGRAM



1. Gasket—Intake Manifold
2. Intake Manifold Assembly
3. Hexagonal Flange Bolt
4. Throttle Valve Body Assembly
5. Gasket—Throttle Valve Body Assembly
6. Oil injector Assembly
7. Fuel Distribution Pipe Assembly
8. Bracket

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1. Intake Valve
2. Valve Oil Seal
3. Valve Spring Seat
4. Valve Spring
5. Valve Spring Retainer
6. Keeper
7. Exhaust Valve
8. Intake Camshaft Assembly
9. Bearing Cap Assembly
10. Control Valve-Camshaft Phaser Assembly
11. First Bearing Cap Assembly
12. Front Camshaft Oil Seal
13. Exhaust Camshaft Assembly
14. Rocker Arm Assembly
15. Hydraulic Tappet Assembly
16. Stud Bolt (9 Bars)
17. Cylinder Head Gasket
18. Temperature Sensor
19. Engine Hanger
20. Cylinder Head Bolt
21. Cylinder Head Assembly

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II. MAINTENANCE

2.1 Replace intake manifold, delivery pipe and oil injector

2.1.1 Needed tools and auxiliary materials

Ratchet wheel, ratchet rod, 10# sleeve and crosshead screwdriver

2.1.2 Process of removal

1) Put the ignition key at the OFF position.

2) Loosen the plug of oil injector.

3) Remove the connecting bolt between engine oil dipstick and intake manifold.

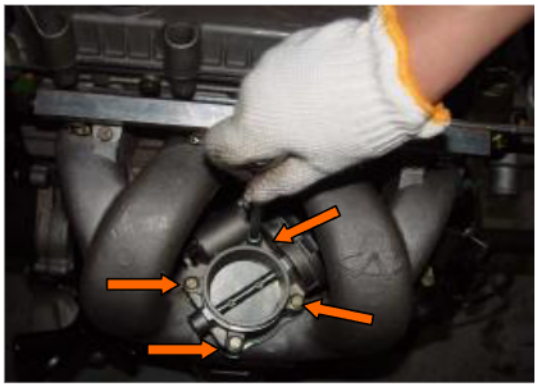




4) Remove the clamp between intake hose and throttle valve body.

5) Remove the connecting bolt of throttle valve body, and take out throttle valve body.

Note: Because this throttle valve body is electronic, do not force the middle vanes turning manually or with other objects.



6) Loosen the joint of oil intake pipe.

7) Remove the fastening nut of intake manifold and take out the intake manifold.



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2.1.3 Installation steps

The installing steps are reverse to those for removal.

2.2 Replace camshaft, bearing bushings, valve and valve oil seal.

2.2.1 Needed tools and auxiliary materials

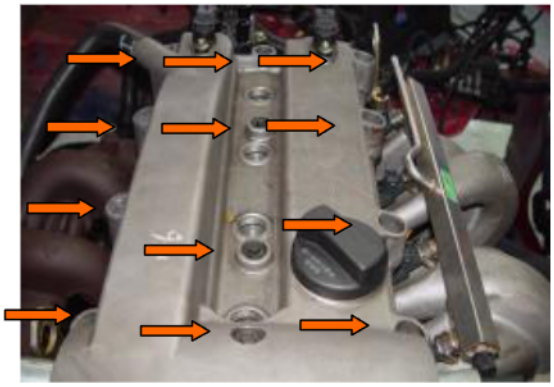
Special tools for valve oil seal, engine transmission oil, a set of sleeve tools, an adjustable spanner, special tools for timing and a set of Allen wrenches

2.2.2 Removal

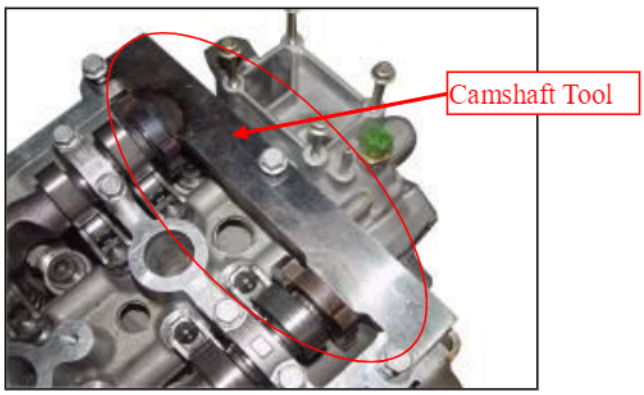
1) Remove the dynamo belt (see "removal of dynamo belt" for details).

2) Remove the timing belt (see "replacement of engine timing belt and timing calibration" for details).

3) Remove the cover of engine valve chamber.



4) Clamp the timing special tool into camshaft slot and fasten the bolt.



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5) Dismantle the belt pulley of air intake and exhaust camshafts with torque wrench.



6) Remove the back cover of timing belt.



7) Dismantle the bearing caps of air intake and exhaust camshaft respectively and put them down in the sequence.

Note: The second, third, fourth and fifth camshaft bearing caps are marked with I1, I2, I3, I4 (E1, E2, E3, E4), which stands for the corresponding bearing cap of 1, 2, 3, 4 cylinder respectively. ("I" refers to intake camshaft, "E" refers to exhaust camshaft).

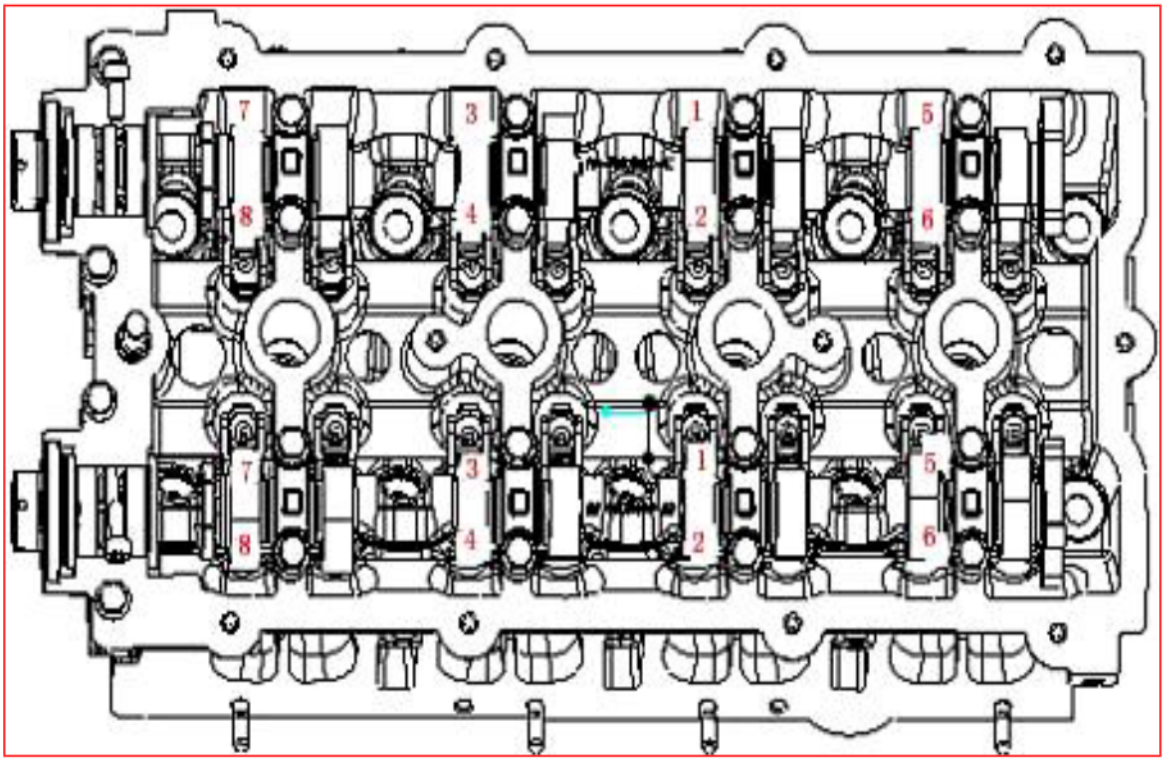
Torque:





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See the following picture for removal sequence of intake and exhaust camshaft-bearing caps:



8) Take out the camshaft and the hydraulic tappet.

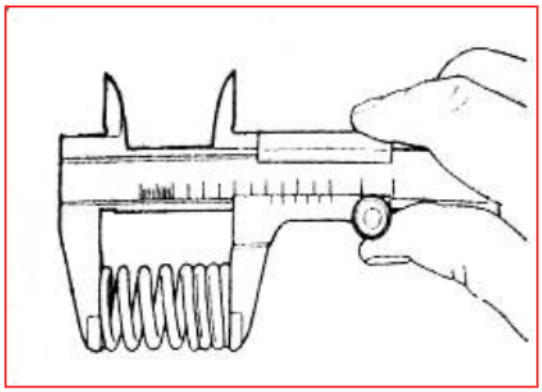
9) Remove the valve spring with special tools. (Picture is unavailable)

10) Remove the used valve oil seal with special tools. (Picture is unavailable)

2.2.3 Inspection

1) Check the valve spring.

Measure the free length, the verticality and the length under special pressure with caliper.



	Standard Value(mm)
Free length	47.7
Length of 620N	32

Replace with the new valve spring if the measured value exceeds the limit value.

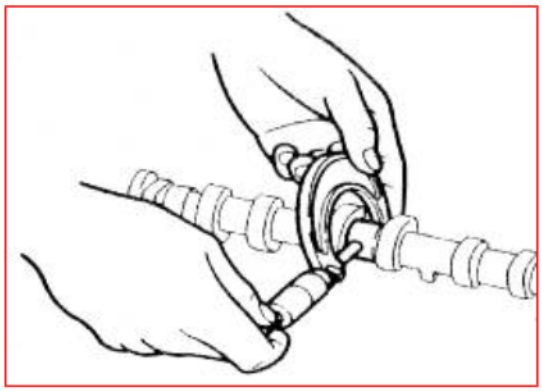
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2) Check camshaft

Measure the camshaft diameter with micrometer caliper.

	Standard Value (mm)	Limit Value (mm)
Diameter	$\phi 24_{-0.053}^{-0.040}$	

Replace with the new camshaft if the measured value exceeds the limit value.

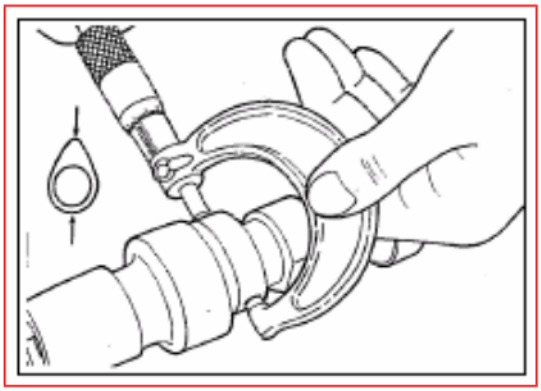


3) Examine camshaft

Measure the high of cam with micrometer caliper.

	Standard Value (mm)	limit value (mm)
Intake Cam	37.15	
Exhaust Cam	37.05	

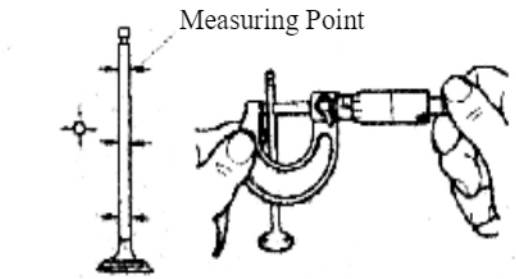
Replace with the new camshaft if the measured value exceeds the limit value.

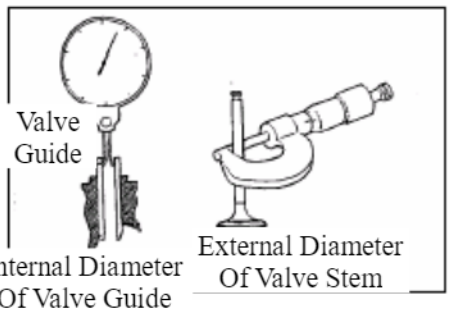


4) Examine diameter of valve stem

a: Measure the diameter of valve stem with micrometer caliper.

See the picture for measuring points: they are 26, 52, and 78 mm from measure positions to bottom of valve.



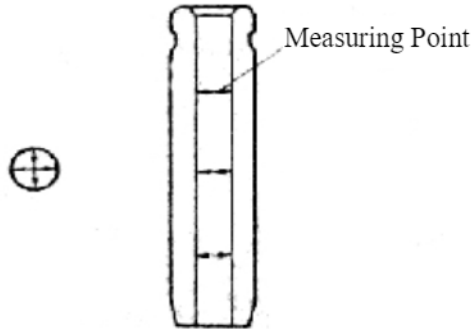


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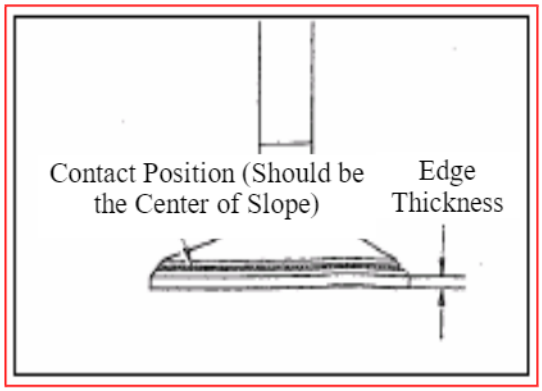
b: Use internal micrometer guage to measure the internal diameter of valve guide and the measuring point is a quartering point of guide.

c: Calculate the difference of measured value and the clearance.

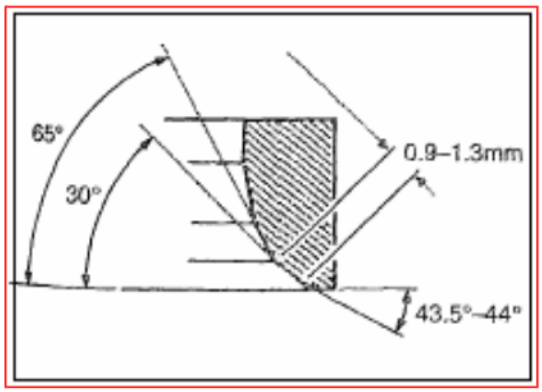
Replace the valve or the guide if the value exceeds the limit value.



d: Examine the contact bandwidth of valve.



e: Check the valve seat insert.

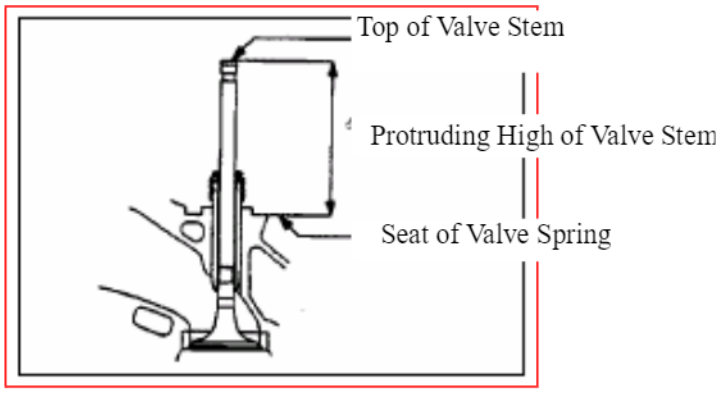


		Standard Value
Outer Diameter of Valve stem (mm)	IN	¢ 5.98±0.008
	EX	¢ 5.96±0.008
Inner Diameter of Valve guide (mm)	IN	¢ 5.4±0.1
	EX	¢ 5.4±0.1
Clearance (mm)	IN	0.02
	EX	0.04
Thickness of Valve Top （mm）	IN	0.3±0.15
	EX	0.3±0.15
Seal Bandwidth （mm）	IN	1.158
	EX	1.306

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f: Examine the protruding capacity of valve stem.

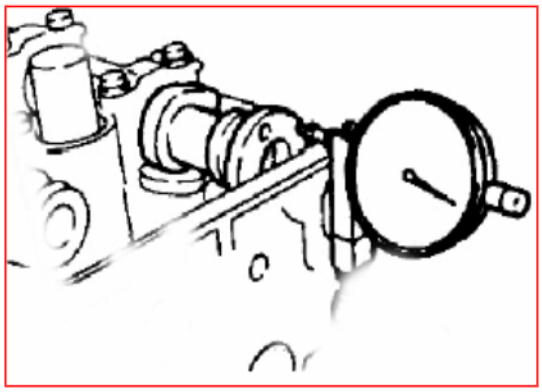
And Examine the protruding high of valve stem with vernier caliper. （See picture）



	Standard Value（mm）
Protruding Capacity Of Intake Valve stem	47.5
Protruding Capacity Of Exhaust Valve stem	47.5

5) Examine the axial clearance of camshaft.

Replace the camshaft if the value of axial clearance exceeds the normal value.

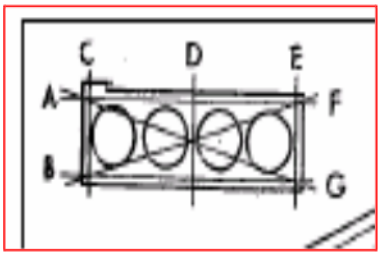


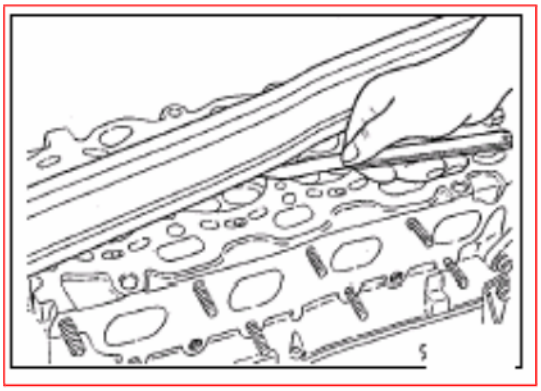
	Standard Value
Intake camshaft	0.015—0.02
Exhaust camshaft	0.015—0.02

6) Examine the planeness of cylinder

a: Clear the lower surface of cylinder head.

b: With the help of ruler and feeler gauge, check whether the lower surface of cylinder head is warped.(Measure it in the sequence of A, C, D, E, F, G in the picture)





	Standard Value
Cylinder head planeness	0.04

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C: Revise it if the planeness exceeds, and replace when it exceeds the limit value.

The permitted maximum abrading thickness between cylinder block and cylinder head is:

2.2.3 Installation

The installing steps are reverse to those for removal.

Note:

1) Dismantle valve springs into groups. The 1st and 4th cylinders are in one group and the 2nd and 3rd ones are in the other group. Then put the piston to the upper point of 1st and 4th cylinders in order to dismantle the valve spring of 1st and 4th cylinders, replace their valve oil seal and mount the spring immediately. And put the piston to the upper point of 2nd and 3rd cylinders in order to replace the other valve oil seal. Those steps prevent from that the valve falls into cylinder and the unanticipated trouble occurs.

2) Wipe the engine transmission oil on the opening of oil seal when mounting the valve oil seal.

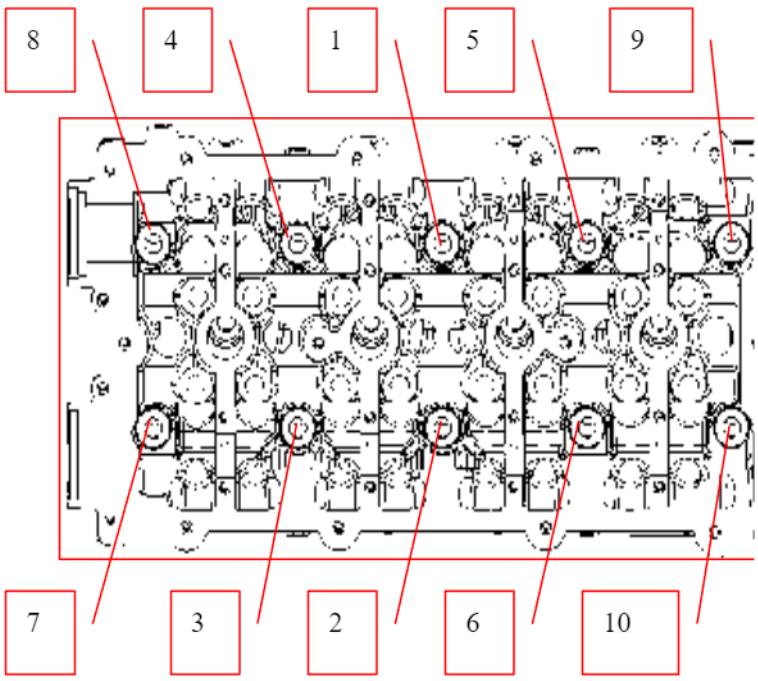
3) Fasten the cylinder bolt as the following process.

A: Smear some oil on the top and root of bolt.

B: Fasten to 40±5NM in sequence.

C: Fasten 90±5 degree clockwise.

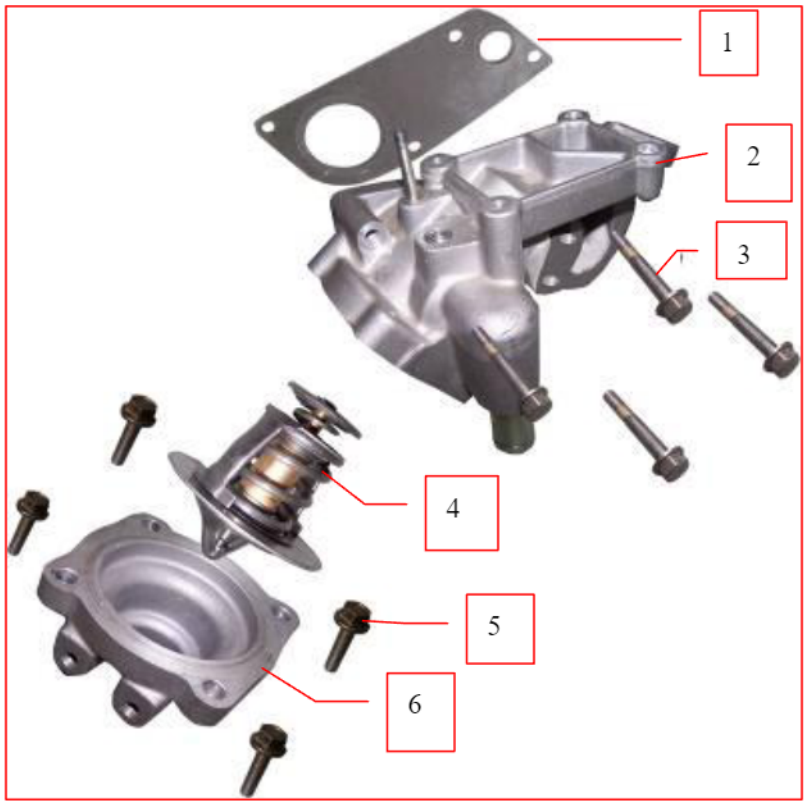
D: Fasten 90±5 degree clockwise.



2.3 Replace thermostat

2.3.1 Structural diagram

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1. Pad—Thermostat Seat
2. Thermostat Seat
3. Hexagonal Flange Bolt
4. Thermostat Assembly
5. Hexagonal Flange Bolt
6. Cover—Thermostat Seat

2.3.2 Needed tools and auxiliary materials

Hatch clamp,10# sleeve, ratchet wheel and wrench

2.3.3 Removal

1) Loosen the clamp of thermostat water exhaust pipe with hatch clamp to release the coolant.

Note: Do it after the temperature decreased to prevent scald.

2) Remove the 4 bolts of thermostat cover with 10# sleeve wrench.

3) Take out the thermostat.

2.3.4 Inspection

Put the thermostat in the boiling water and use it with thermometer. Then observe the temperatures when the thermostat is turning on and fully opened.

	Temperature value
Regular unlocking temperature	87℃
fully opened temperature	104℃

Replace the new thermostat if the measured value is abnormal.

2.3.5 Installation

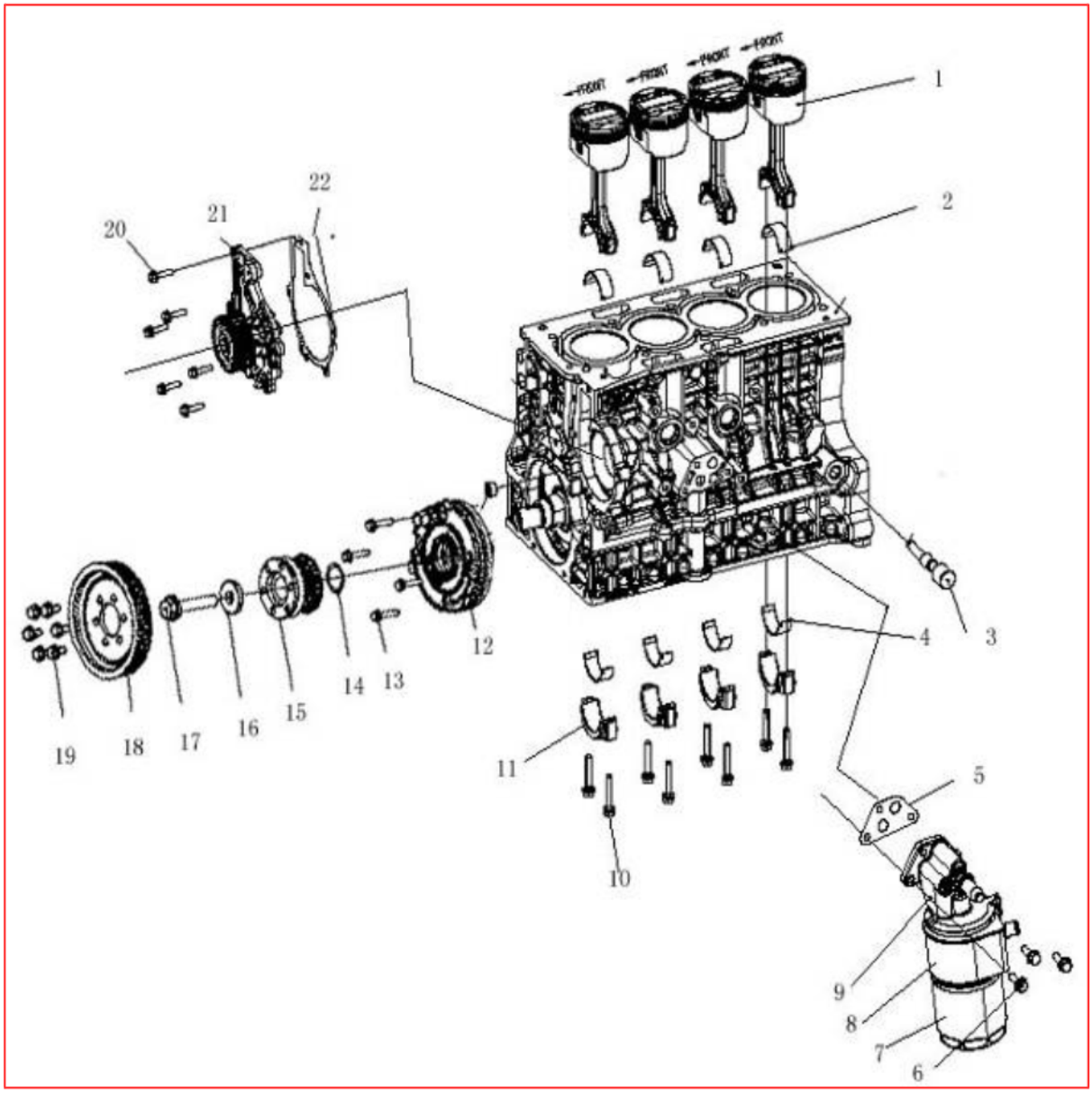
The installing steps are reverse to those for removal.

Note: Fill in the engine coolant with fixed quantity after installation.

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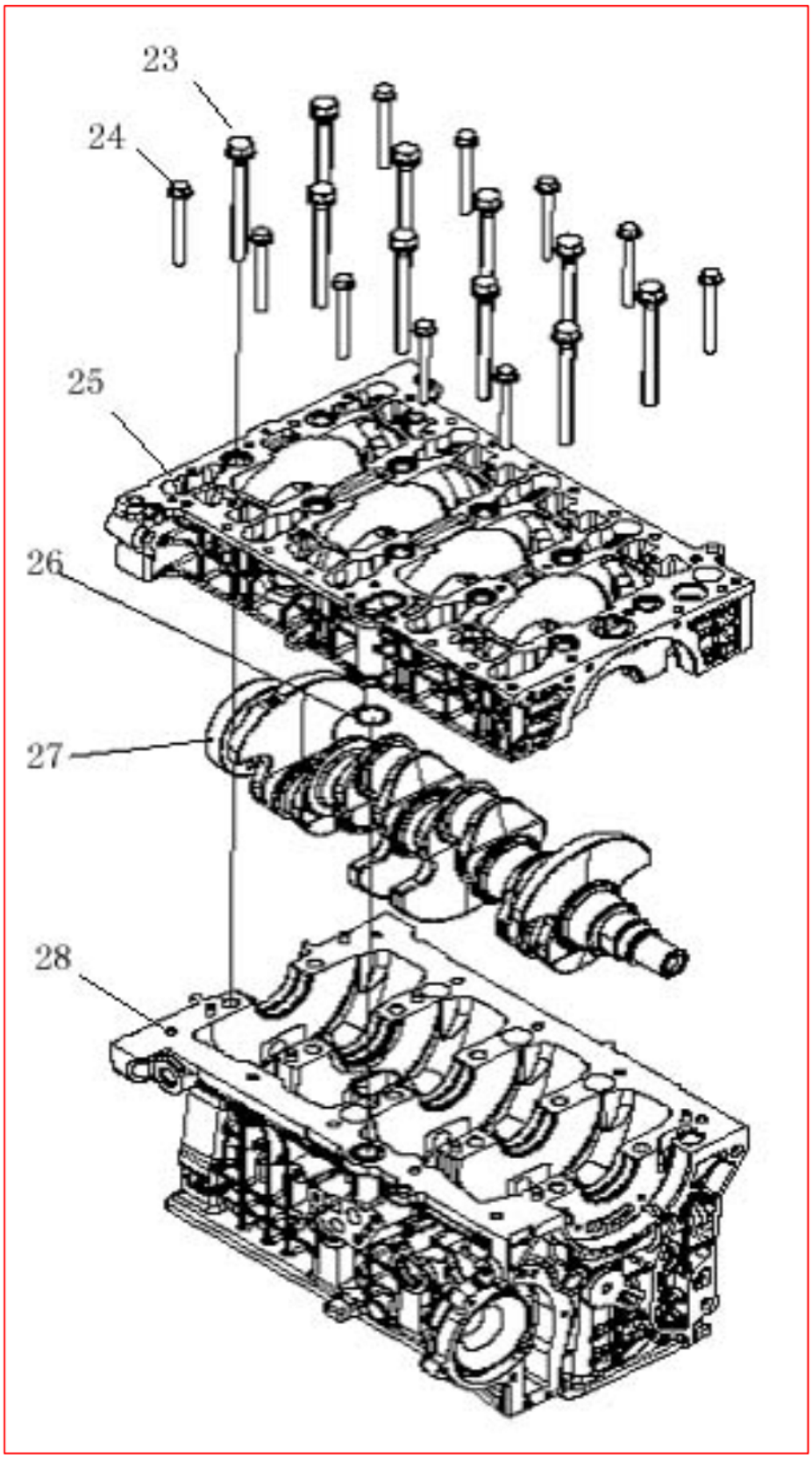
SECTION III SHORT ENGINE

I. STRUCTURE DIAGRAM



1. Piston
2. Connecting Rod Upper Bearing
3. Timing Hole Plug
4. Connecting Rod Lower Bearing
5. Pad
6. Bolt
7. Oil Filter
8. Oil Cooler
9. Oil Filter Seat
10. Connecting Rod Bolt
11. Connecting Rod Bearing Cap
12. Oil Pump
13. Bolt
14. Gasket
15. Crankshaft Timing belt pulley
16. Gasket
17. Bolt
18. Crankshaft Pulley
19. Bolt
20. Bolt
21. Coolant pump
22. Coolant Pump Gasket

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23. Crankshaft Main Bearing Bolt
24. Frame Bolt
25. Frame
26. O-Type Ring
27. Crankshaft
28. Cylinder Block

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II. MAINTENANCE

1. Replace oil pan

1.1 Needed tools and auxiliary materials

10# open end wrench, 10#, 15# and 17# sleeve, ratchet wheel and ratchet rod, Le Tai 5901 Glue, engine oil

1.2 Process of Replacement

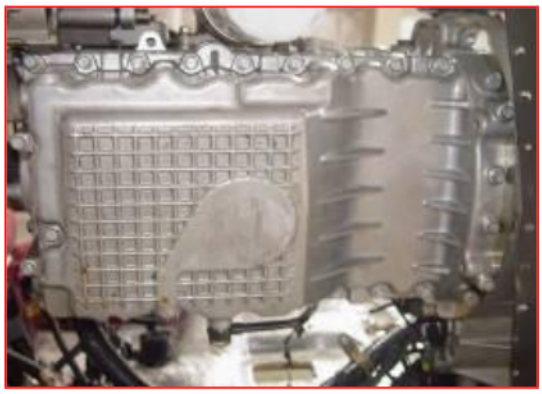
1.2.1 Process of removal

1) Loosen the oil discharge bolt of oil pan to discharge the engine oil.

Note: Engine oil should be stored in special container. And Pay attention to environment protection.



2) Remove the fastening bolt of oil pan with 10# open end wrench and 10# sleeve.（18 bars of M7×25, 3 bars of M7×40,4 bars of M7×95）

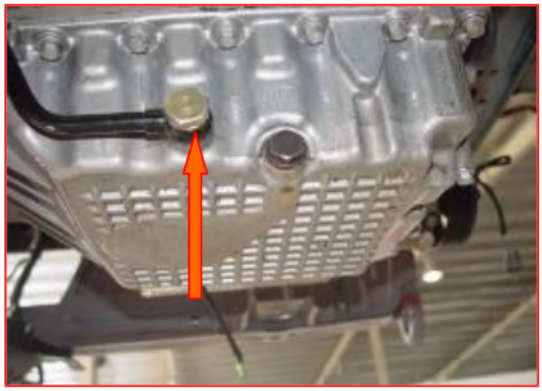


3) Remove the connecting bolt (2 bars, black) between oil pan and transmission housing with 17# sleeve wrench.



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4) Remove the connecting bolt between the oil return pipe of PVC valve and the oil pan with 15# sleeve wrench.



5) Tap the edge of oil pan with rubber pestle, and then remove the oil pan.

Note: Pay attention to safety because the oil pan might fall down when being tapped.

6) Clean the engine frame with right-angled tool to get rid of old Le Tai glue.

Note: Do not lacerate the frame surface.

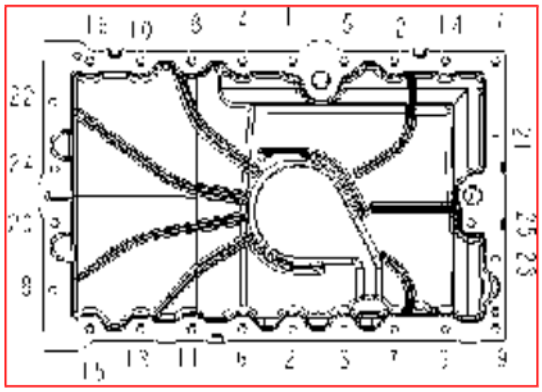


1.2.2 Installation

1) Spread Le Tai 5910 glue on the connection surfaces of frame and oil pan, close the oil pan and fasten the fastening bolt of oil pan.

Note: Spread glue to the inner of hole for installing bolt on the oil pan!

2) Screw the bolt. Screw to combine enough at first then to get specified Torque.



See the diagram for screwing sequence.

Torque: 15±3NM

3) Infuse engine oil to specified capacity.

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2 Replace the engine oil strainer

2.1 Needed tools and auxiliary materials

10# open end wrench, 10#, 15#, 17# sleeve, ratchet wheel and ratchet rod, Le Tai 5901 Glue, engine oil

2.2 Process of replacement

2.2.1 Process of removal

1) Remove the oil pan.（See "replace oil pan" for details）

2) Remove the connecting bolt between engine oil strainer and frame with 10# sleeve wrench.（total 8 bars）



3) Draw out the engine oil strainer carefully.

2.2.2 Installation

1) Spin the nozzle of engine oil strainer into the frame carefully.

2) Mount the 8 bolts for the strainer and fasten them.

Note: the bolts should be mounted with Le Tai 243 glue.

Torque: 8±3Nm

3) Install oil pan (See "installation of oil pan" for details).

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3 Replace the piston, piston ring, piston pin and connecting rod bearing

3.1 Needed tools and auxiliary materials

10# open end wrench, 10#, 15#, 17# sleeve, ratchet wheel and ratchet rod, Le Tai 5901 Glue, engine oil, torque wrench Special tools for installing piston, feeler gauge, clearance gauge, micrometer caliper

3.2 Process of replacement

3.2.1 Process of removal

1) Dismantle the timing belt (see "dismantle the timing belt" in the section of "replacement of engine timing belt" for details).

2) Remove the oil pan（see REPLACE OIL PAN for details.

3) Remove the cylinder head. (see "removal of cylinder head" for details).

4) Dismantle the engine oil strainer (see the "replacement of engine oil strainer" for details).

5) Loosen the big bolt on connecting rod.



6) Remove the connecting rod bearing lower cover.



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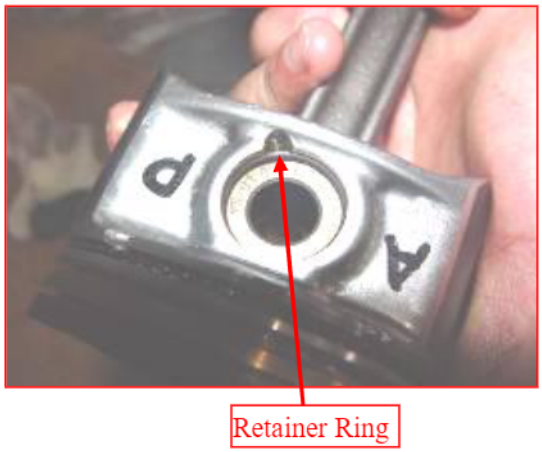
7) Uplift the connecting rod and the piston with a wooden stem and then remove the connecting rod and piston assembly.



8) Remove the piston ring.

9) Remove the retainer ring of piston pin and draw out the piston pin.

Note: With large tension, the retainer ring may hurt people in the process of removal.

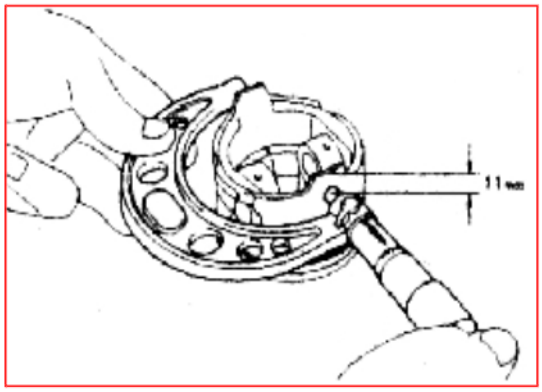


3.2.2 Inspection

I. Check piston

1) Examine the diameter of piston.

Measure the diameter along the vertical direction to piston pin and at the place 11mm under piston skirt with micrometer caliper.



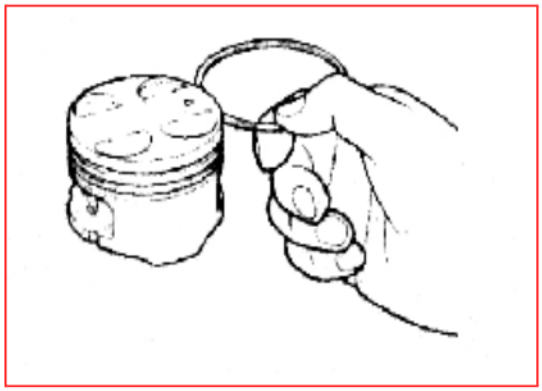
Cylinder No.	Standard Size
1	83.46±0.009
2	83.46±0.009
3	83.46±0.009
4	83.46±0.009

Replace with the new one if the part cannot be worn and torn any longer.

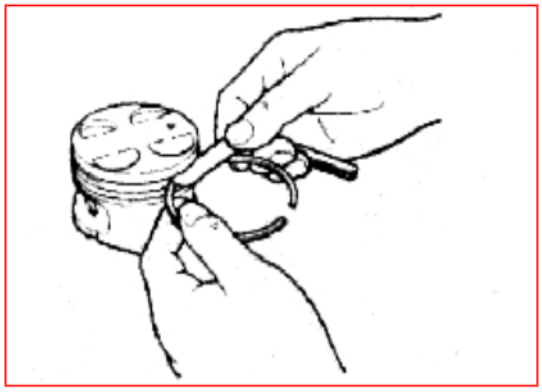
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2) Examine the clearance between piston ring and ring groove.

a. Clean up the accumulated carbon in the ring groove with piston ring.



b. Examine the clearance between piston ring and ring groove with feeler gauge.

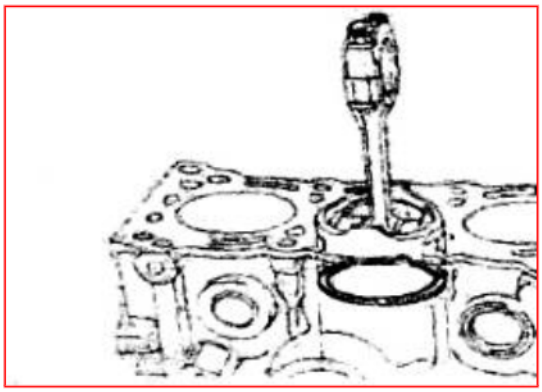


	Reference Value（mm）
1st Ring	0.04--0.08
2nd Ring	0.01--0.025

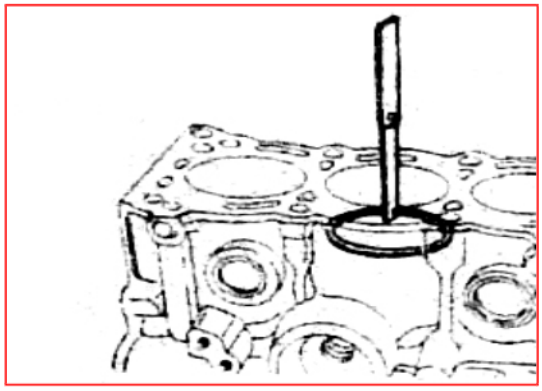
Replace with the new one if the examined clearance cannot be worn and torn any longer.

3) Inspect the end clearance of piston ring.

a. Put the piston ring at the position 45mm below the top surface of cylinder aperture and push the piston ring into cylinder with piston.



b. Measure the opening with feeler gauge.

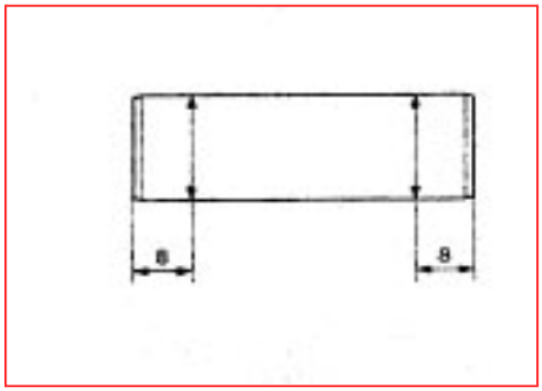


Replace with the new piston if the examined clearance exceeds the limit.

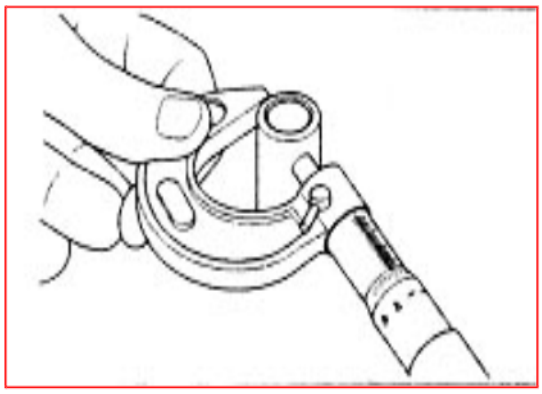
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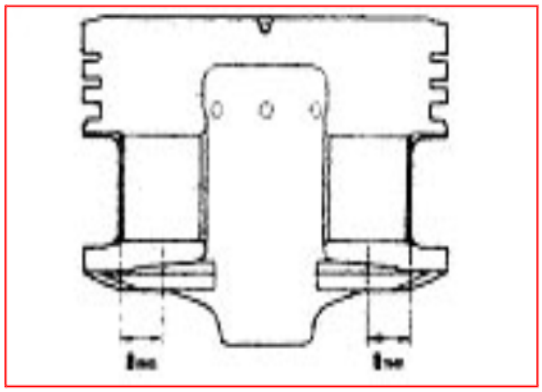
4) Inspect the diameter of piston pin and piston pin hole.

a. As the following picture, measure the piston pin position around with micrometer caliper. And take the maximum value as the diameter of piston pin.

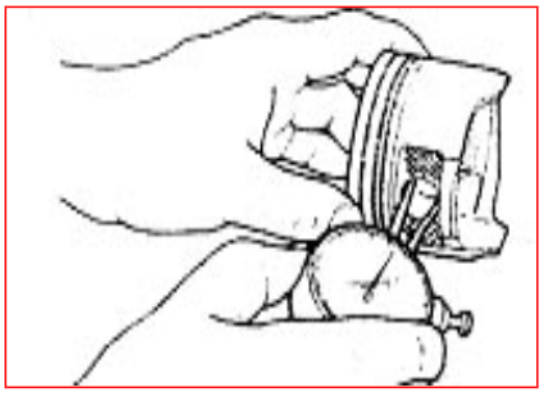


b. Measure the diameter of piston pin hole around with micrometer guage for inside diameter, as the following picture, and take the minimum value as the diameter of pin hole.





	Standard Size
Diameter of piston pin	$21^{0}_{-0.005}$
Diameter of piston pin hole	$21^{0.008}_{0.002}$



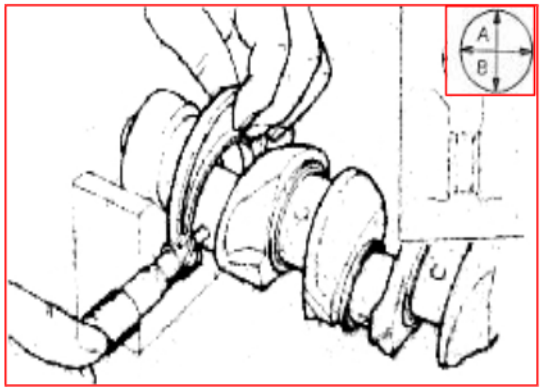
Replace with the new piston and pin if the examined clearance exceeds the limit.

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5) Inspect the connecting rod journal and connecting rod bearing

a. Examine the diameter of connecting rod journal.

Measure the axle diameter of connecting rod with micrometer caliper.

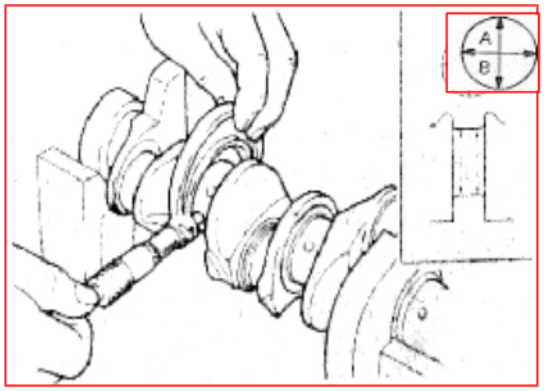


Rotate the crankshaft 90° and measure it again.

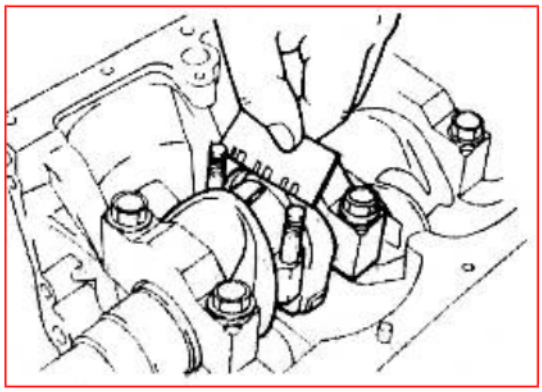
Work out the Roundness and cylindricity through twice measuring.

① Roundness=Max. diameter — Min. diameter /2 as the picture, take the vertical diameters on the same plane, subtract the half of Minimum from the Maximum to get roundness.

② cylindricity= Maximum bore — Minimum bore/2 As the picture, measure the bores of 3 planes along both A direction and B direction respectively. Get the maximum and the minimum from 6 values, and then subtract the half of Minimum from the Maximum to get cylindricity;



	Standard Value
Diameter	$47.9^{0}_{-0.016}$
Roundness	——
Cylindricity	——



b. Inspect the radial clearance of connecting rod bearing

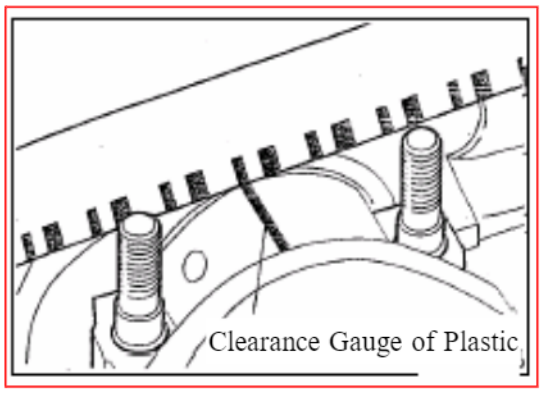
Inspect the radial clearance of connecting rod bearing with clearance gauge. Clean up the connecting rod journal and connecting rod bearing. And put clearance gauge on the journal, fasten bearing bushing and fasten the bolt according to set torque.

Note: Do not rotate the crankshaft during the process.

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Loosen the connecting rod bolt, remove the cap, and measure the maximum width of pressed clearance gauge with the ruler on its package to get the clearance value.

	Standard Value	Abrasion Limit
Clearance	0.016—0.051	



Replace with the new connecting rod bearing if the examined clearance exceeds the limit.

Note: Use the same brand consistent with assorting sign when you replace the bearing bushing.

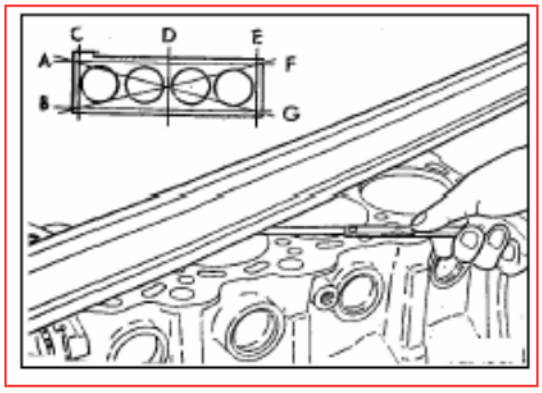
Selection of connecting rod bearing:

You may select the connecting rod bearing by observing the sign on the first balance weight at the front end of crankshaft.（see picture, unavailable）

6) Inspect the planeness of cylinder block surface.

a: Clean the upper surface of cylinder block.

b: Check with ruler and feeler gauge whether the surface of cylinder block is warped. (Measure it in the sequence of A, C, D, E, F, G in the picture)



	Standard Value	limit value
warping amount	0.04	

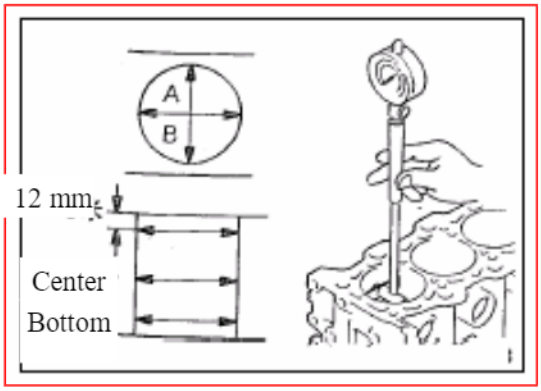
C: Revise it if the warping amount is excessive.

Replace with the new cylinder if it exceeds the limit. The maximum for the sum of permitted abrading thickness of cylinder block and cylinder head is:

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7) Inspect cylinder

a: Inspect if the cylinder wall is scratched or scored. If there are cylinder scoring and scratching you need to hone cylinder wall, replace cylinder liner or replace cylinder block.



b: Examine the inner diameter and cylindricity of cylinder with cylinder gauge.

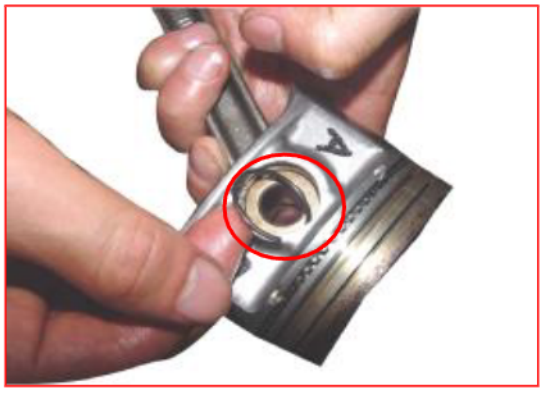
	Standard value
Inner diameter	83.5
cylindricity	0.008

cylindricity= Maximum bore — Minimum bore/2

As the picture, measure the bores of 3 planes along both A direction and B direction respectively. Get the maximum and the minimum from 6 values, and then subtract the half of Minimum from the Maximum to get cylindricity;

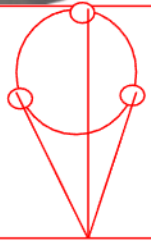
3.2.3 Installation

1) Spread oil on the piston pin and in the piston pin hole, connect the piston and connecting rod with piston pin, and mount the piston pin circlip.



2) Mount the piston ring. Mount the rings on the piston in the sequence of oil ring expander, upper and lower segments, 2nd air ring and 1st air ring; Pay attention to the direction of piston ring, the side with "TOP" should be upward. The two segments and expander are staggered. The angle of expander connector points to the top of piston, and the 1st ring and 2nd ring form 120° with the upper expander.





The Openings Of Rings Form 120°With Each Other

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3) Mount the upper bearing of connecting rod and the connecting rod together.

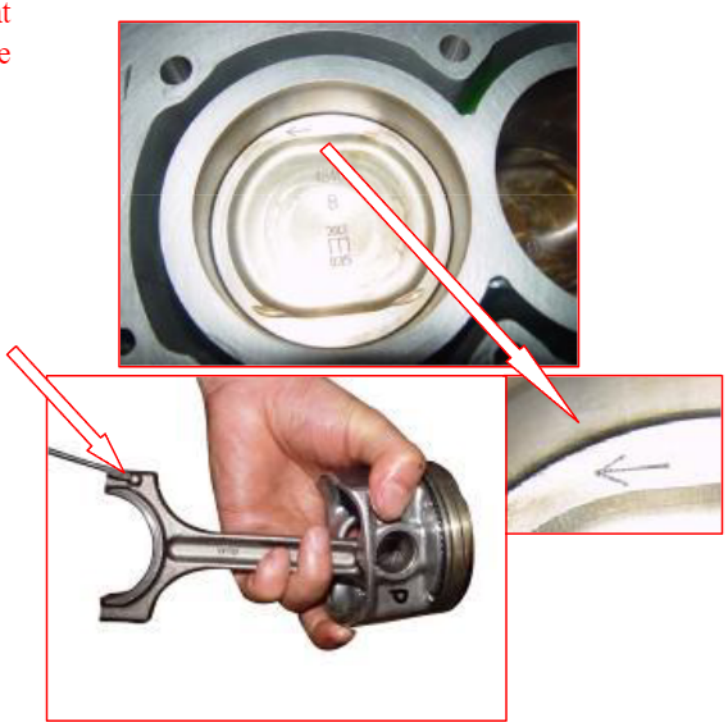
Note: the gap on bushing should be orderly with that of connecting rod.



4) Spread the engine transmission oil in the engine cylinder, clasp the piston ring with special tool, tap the piston head with wooden handle and encase the piston connecting rod assembly.



Note: the end of connecting rod with a point should face the cylinder and consists with the arrowhead on the top side of piston.



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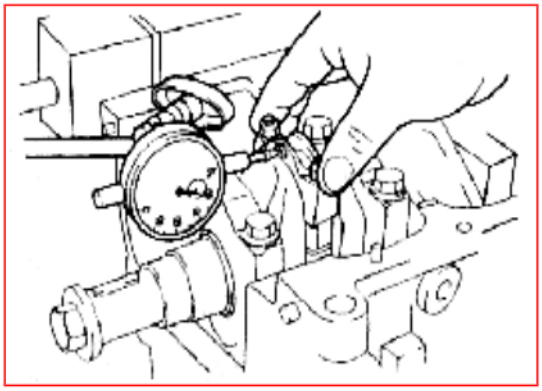
5) Mount the lower bearing of connecting rod and the connecting rod cap together. Then spread engine transmission oil.

Note: the gap on bushing should be orderly with that of connecting rod.



6) Close the connecting rod cap and screw down the bolt.

Torque: 25±3N•m, then screw 90°±5°



7) Examine the axial clearance of connecting rod.

Examine the axial clearance with micrometer guage or feeler gauge.

	Standard Value（mm）
Clearance	0.15—0.50

8) Mount the engine oil strainer.

9) Mount the oil pan.

10) Mount the cylinder head.

11) Mount the timing belt during timing adjusting.

4.Replace front oil seal of crankshaft

4.1 Needed tools and auxiliary materials

Ratchet wheel and ratchet rod, 13#, 15#, 17#, 22# sleeve, 13# open end wrench, allen wrench, engine transmission oil and guide sleeve of crankshaft oil seal



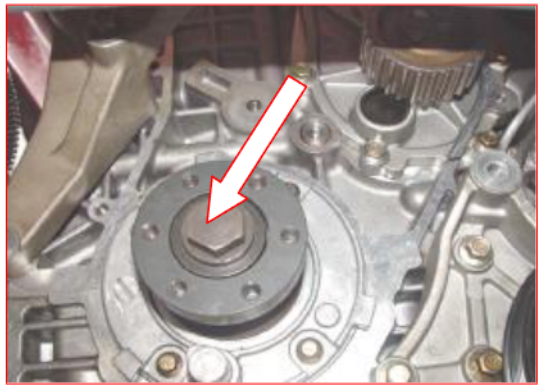
4.2 Process of Replacement

4.2.1 Process of Removal

1) Dismantle the timing belt (See "replacing the timing belt" for details).

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2) Engage the gear to 5th, then press the brake with toes, Dismantle the connecting bolt of timing belt pulley and crankshaft with torque wrench. Remove the timing belt.



Torque:130±10,then screw 65°±5°

3) Pry out the old oil seal with right-angled screwdriver carefully.

Note: Be careful in dismantling the oil seal not to damage the oil seal seat ring.

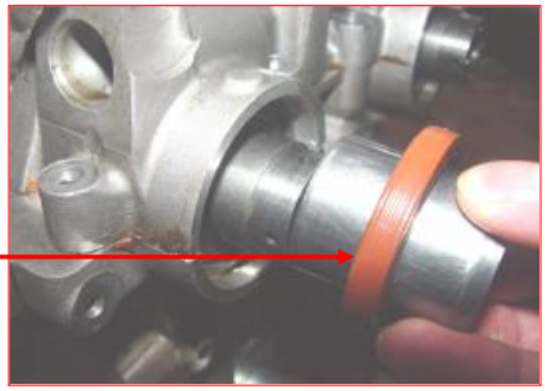
4.2.2 Installation

1) Clean the oil seal seat ring and spread transmission oil on the seat ring

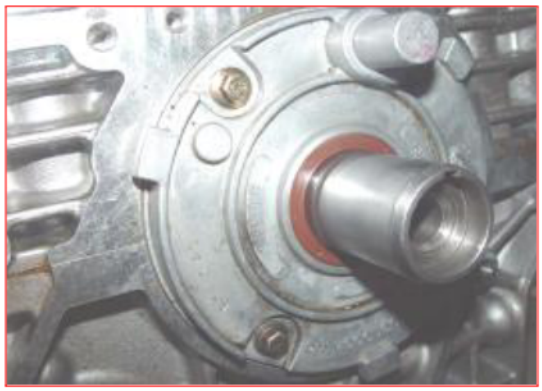


2) Spread transmission oil at the seal lip.

3) Enclose the guide sleeve of crankshaft oil seal, special tool, with that oil seal.



4) Press the oil seal into oil seal seat ring and knock it to right position with hammer.



5. Replacement of oil pump

5.1 Needed tools and auxiliary materials

A set of big sleeves, a set of small sleeves and a set of open end wrench

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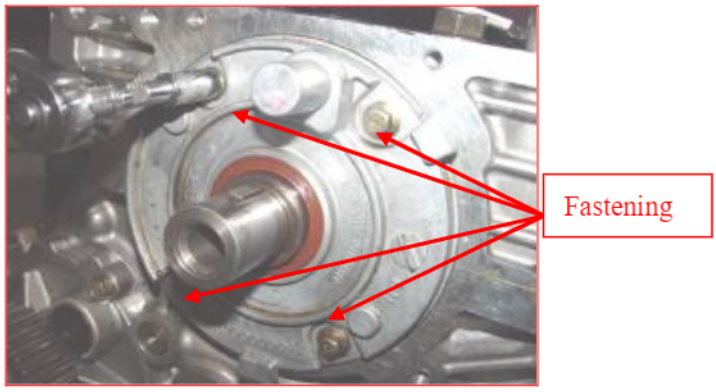
5.2 Process of Replacement

5.2.1 Process of Removal

1) Dismantle the timing belt (See "removal of timing belt" for details).

2) Engage the gear to 5th, then press the brake with toes, and remove the timing belt pulley.

3) Dismantle the fastening bolt of oil pump with 10# sleeve and take out the oil pump. Torque:8+3NM



4) Pry out the oil seal.

5) Clean the seat ring of oil pump.

5.2.2 Installation

1) Spread oil on the gasket of oil pump.

2) Mount the oil pump in its seat ring.

Note: The bulge of oil pump should be put downwards because the wrong position can not make the bolt be screwed in.

3) Mount the oil seal.

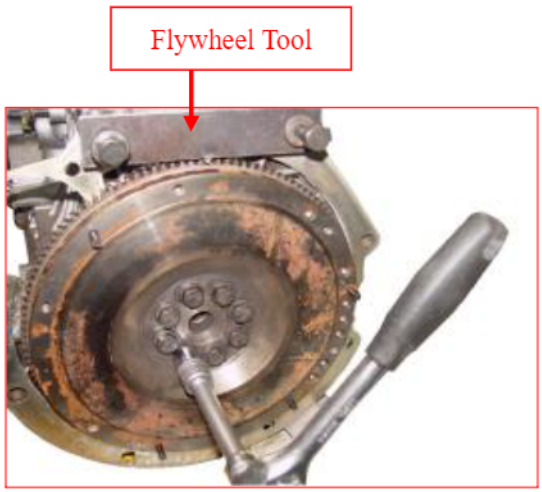
4) Mount the other parts.

6. Replacement of crankshaft rear oil seal

6.1 Needed tools and auxiliary materials

A set of big sleeves, a right-angled screwdriver, a small hoist and engine oil

6.2 Process of Removal



1) Suspend the engine assembly from vehicle (See "suspending of engine assembly" for details）.

2) Remove the clutch pressure plate.

3) For removing the flywheel, lock the flywheel with special tool and then screw off the fastening bolt with sleeve wrench.

4) Pry the old oil seal with the right-angled screwdriver.

Note: Do not damage the oil seal seat ring.

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6.2 Installation

1) Clean the oil seal seat ring. Clean the oil seal seat ring with clean oiled gauze.



2) Spread the oil at the lip of crankshaft front oil seal.

Enclose the guide sleeve of crankshaft oil seal, special tool, with that oil seal. Then press it into oil seal seat ring.



3) Mount the flywheel and the clutch pressure plate, and then mount the engine on the vehicle.

Torque:25±5N.M, then screw 30°±5°.

7. Replace crankshaft and thrust washer

7.1 Needed tools and auxiliary materials

A set of open end wrenches, a set of sleeve tools, a small hoist, Le Tai glue, Engine oil, feeler gauge, feeler gauge, micrometer gauge.

7.2 Process of Removal

1) Suspend the engine assembly from vehicle (See "suspending of engine assembly" for details）.

2) Drain out the engine oil.

3) Remove the timing belt (see "replace timing belt" for details).

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4) Dismantle the accessories, such as dynamo, A/C compressor, power steering pump and bracket. （See the “replacement of engine accessory” for details）

5) Dismantle the engine cylinder head assembly. （See the “replacement of cylinder head” for details）

6) Dismantle the engine clutch pressure plate, the flywheel and the timing belt pulley.

7) Remove the oil pan and engine oil strainer.（See the “replacement of oil pan and strainer” for details.）

8) Remove the piston connecting rod assemblies for 4 cylinders and Put them in order.

Note: You’d better stick the number on each piston connecting rod assembly to prevent from wrong mounting.

9) Dismantle engine oil pump assembly.

10) Dismantle the frame assembly under cylinder block and remove the crankshaft and thrust washer.

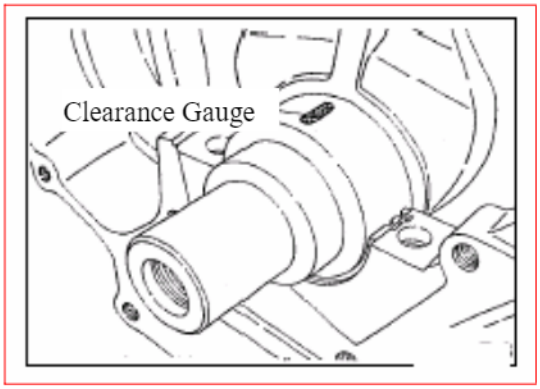
7.3 Inspection

1) radial clearance of crankshaft

a): Clean the journal and bearing bushing.

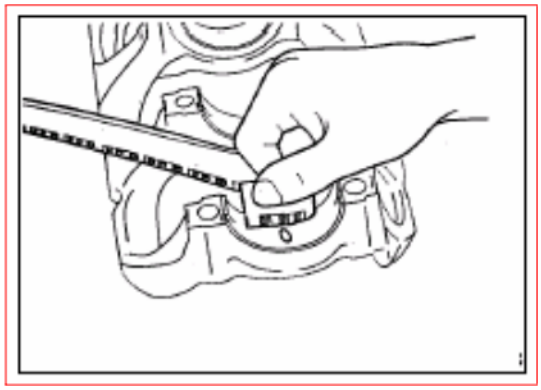
b): Install crankshaft

c): Make the length of plastic clearance gauge equal to the width of bearing. Then put it on the journal paralleling the axis.



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d): Mount the main bearing cap carefully and screw down the bolt with specified torque.



e): Dismantle the main bearing cap carefully.

f): Measure the width at the most bread part of pressed plastic line with ruler on plastic clearance gauge package, then get clearance value.

	Standard Value
Clearance	-0.0035-0.034

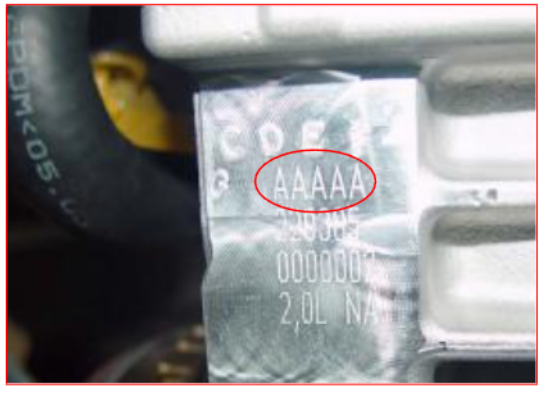
Replace the new bearing bushing if the measured clearance value exceeds the limit value.

Note: Replace the whole group when replacing bearing bushing.

Selecting method of main bearing bushing:

By observing the sign on cylinder (see the picture), we could see 5 As which correspond to bearing bushings respectively.

There two kinds of signs on this vehicle, A and B, corresponding to two kinds bushing, red one and blue one (the color can be recognized on the new bushing but it is possible unrecognized the color on the old one.) A corresponds to red bushing, and B corresponds to blue bushing.



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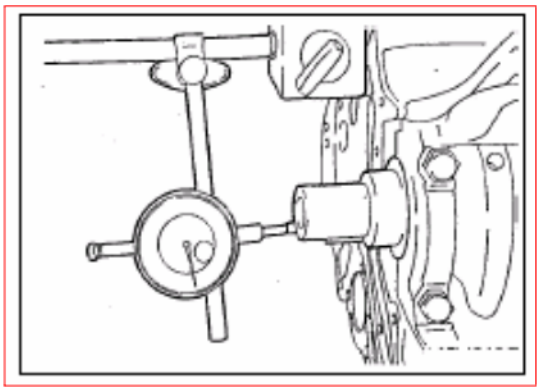
2) Inspect the crankshaft axial clearance

Mount the crankshaft and measure its radical clearance with micrometer guage.

	Standard Value
Clearance	0.076—0.265

Replace the new thrust washer if the measured value exceeds the limit value.

Standard thickness of thrust washer:



7.4 Installation

1) Clean the engine and spread the engine transmission oil on the crankshaft journal.

2) Mount the crankshaft correctly and then mount the thrust washer.



3) Mount the cylinder frame and screw down the crankshaft fastening bolt.

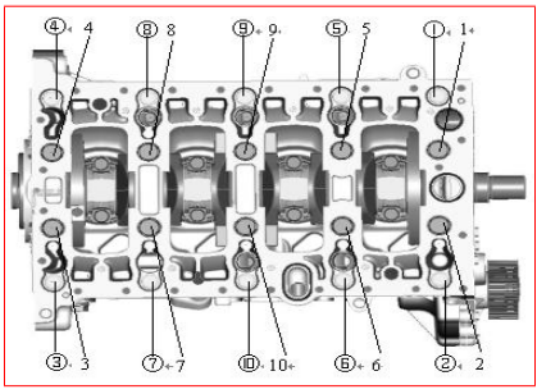
See the picture for the screwing sequence

Screwing way and Torque:

A: Pre-fasten the bolt according to the sequence in the picture.

B: Screw the bolt as the sequence on the picture to 45±5 N.m.

C: Screw 180±5°



4) Mount and screw down the bolt of frame periphery.

Torque: 23N.m

5) Mount the engine oil strainer, oil pan, crankshaft front and rear oil seal and oil pump.

6) Mount the engine accessories, suspend the engine assembly from vehicle and

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mount the water pipe and insert electric connector.

8 Replace coolant pump

8.1 Needed tools and auxiliary materials

A box sleeve wrench, a set of open end wrench, allen wrench, coolant

8.2 Removal

1) Remove the engine timing belt.（see "engine timing calibration" for details.）

2) Loosen the engine water exhaust pipe, and exhaust coolant.

3) Removal the coolant pump.

8.3 Installation

The installing steps are reverse to those for removal.

Infuse enough coolant after installation.

Note: Do not splash the coolant on the timing belt and skin.

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