Service Manual for Chery QQ6

(SQR473F Engine-Mechanical)

After Sales Service Department of Chery
Automobile Sales Co., Ltd

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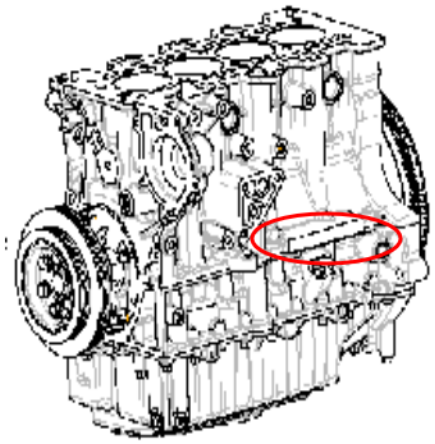
Chapter One Introduction of Characteristics

I. Overview

SQR473F engine is one of the ACTECO series engines that are jointly designed and developed by Chery company and AVL-a world famous engine design company. This engine adopts such advanced technologies as overhead double camshaft structure, 4 air valves, electronic throttle body and electronic accelerator pedal etc. In terms of such mandatory standard indexes as emission and noise, this engine is outdoes national standard and has reached overseas advanced stage.

II. Number Position of the Engine

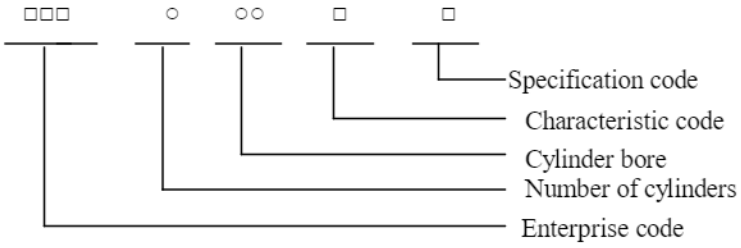
Number of the engine locates at right side of oil filter where bearing shell cover and cylinder block join.



III. Connotation of Engine Number

Each engine has a unique number, from which you can know some characteristics and information of the engine. Engine model should conform to requirements in GB725 and is consisted of enterprise code, number of cylinders of the engine, bore, characteristic code and specification code.

A complete engine model is as follows:



Among which, ○ indicates an Arabic numeral while □ indicates a letter.

The enterprise code is stipulated as SQR;

Number of cylinders of engine is a 1-2 digit integer;

The bore refers to diameter of cylinder sleeve, which is specified by a 2-3 digit integer with the decimal part rounded and millimeter as unit.

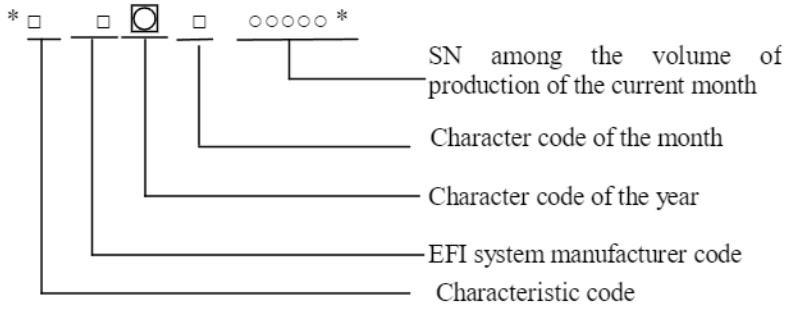
Characteristic code: indicates the most basic characteristics of an engine and is specified by 1 digit upper case English letter.

Specification code: specified by 1 digit upper case English letter, which is used as an additional distinguish code when distinguish is required in case structure, principal parameter or oil supply mode etc. has changed (for example, the stroke of engine has changed or the engine is a dual fuel engine) with number of cylinders, bore and characteristic code of the engine unchanged. For changes of peripheral parts of the engine (such as intake and exhaust manifolds), the engine model will keep unchanged, and engine assembly number will be changed for distinguish. Among the engines of the same series, the specification code will be used with "B" as the first (among which, do not use such letters as "I", "O", "Q", "X" and "Z"). The default specification code for the first fundamental structure is "A", which is omitted. The specification also can quote the characteristic code to express specific characteristics.

Position of engine model

The engine model should be printed at an obvious part on engine cylinder block and please see provisions in ***Assembly and Regulation Instruction of Engine*** for the specific position.

Leaving factory number of engine is composed of characteristic code of engine, EFI manufacturer code, character code of the year of production, character code of the month of production, sequence number of this engine among the engines of this model manufactured in that month and start stop sign "*". Complete form of leaving factory number of a engine is as follows:



Among which, ○ indicates an Arabic numeral, □ indicates a letter and ◯ indicates an Arabic numeral or a letter.

The characteristic code of engine should conform to above provision.

EFI system manufacturers: C-Motorola; D-Marelli; E-Delphi; F-UAES; G-Siemens; H-Troitec; B-Bosch

Chapter Two Specification

I. Engine Type and Major Parameters

No.	Item	Basic Parameters	
		SQR473	
	Type	SQR473H	SQR473F
		Vertical type, 4 cylinder, water cooling, 4 stroke, in-line double overhead camshaft, controlled burn rate, variable valve timing	Vertical type, 4 cylinder, water cooling, 4 stroke, in-line double overhead camshaft
1	Model	SQR473H	SQR473F
2	Fuel Supply Mode	Multi point electric control gasoline injection	
3	Cylinder Diameter (mm)	73.0	
4	Piston Stroke (mm)	77.5	
5	Working volume (L)	1.297	
6	Compression Ratio	10.0	
7	Type of Combustion Chamber	Ridge type	
8	Ignition Sequence	1-3-4-2	
9	Fuel Designation (not less than)	93# lead-free gasoline	
10	Volume of Engine Oil (L)	3.5 (new engine oil filter)	
11	Engine Oil Designation	SAE10W-40 (grade SJ or above)	
12	Crankshaft Rotational Direction	Clockwise (see from engine belt)	
13	Starting Mode	Electric starting	
14	Cooling Mode	Mandatory circulating antifreeze cooling	
15	Lubricating Mode	Combined type (pressure and splash lubrication)	
16	Net Mass (kg)	105	100

17	Crank Angle with Intake Valve Opening as 1mm (°)	400	369
	Crank Angle at 1mm before Intake Valve Closing (°)	610	569
	Crank Angle with Exhaust Valve Opening as 1mm (°)	200	140
	Crank Angle at 1mm before Exhaust Valve Closing (°)	390	350
18	Ignition Advance Angle (°CA)	12±5	12±5
19	Cylinder Compression Pressure (MPa) (200~300r/min)	1.00～1.35	
20	Overall Dimension (length×width×height)	613×507×734	
21	Electronic fuel injection system	UAES	

II. Major Maintenance Parameters of Engine

No.	Name	Dimension and tolerance	Fit clearance
1	473 engine cylinder hole	φ73.005±0.005	0.04
2	Piston skirt of 473 engine	φ72.965±0.009	
3	Main bearing saddle width of cylinder	$19.5^{0}_{-0.05}$	0.07~0.265
	Thickness of thrust plate	$2.4^{+0.05}_{0}$	
	Crankshaft main journal	$24.5^{+0.015}_{-0.030}$	

No.	Name	Dimension and tolerance	Fit clearance
4	Thickness of connecting rod big end	$22^{0}_{-0.1}$	0.15~0.4
	Width of crankshaft connecting rod journal	$22^{+0.30}_{+0.15}$	
5	First piston ring groove height	$1.2^{+0.05}_{+0.03}$	0.035~0.08
	Top compression ring height	$1.2^{-0.005}_{-0.03}$	
6	Second piston ring groove height	$1.5^{+0.04}_{+0.02}$	0.025~0.07
	Second compression ring height	$1.5^{-0.005}_{-0.030}$	
7	piston oil ring groove height	$2.5^{+0.03}_{+0.01}$	0.02~0.18
	Blade height of steel strip composite type oil ring	0.46±0.02	
	Bracing spring height of steel strip composite type oil ring	1.5±0.03	
8	Crankshaft key groove width	$5^{+0.014}_{-0.010}$	
9	Diameter of crankshaft front oil seal	$\Phi 36^{0}_{-0.1}$	
10	Diameter of crankshaft rear oil seal	$\Phi 75^{0}_{-0.1}$	
11	Outside diameter of engine oil dipstick tube	$\varphi 16.7^{0}_{-0.1}$	
	Diameter of cylinder block scale tube orifice	$\varphi 16.7^{+0.043}_{0}$	
12	Diameter of cylinder head valve guide orifice	φ6+0.015	
	Outside diameter of valve guide	φ11x6	-0.022～-0.050
	Diameter of cylinder head valve guide bottom orifice	φ11H7	
13	Outside diameter of intake valve stem	φ5.98±0.008	+0.012～+0.043
	Diameter of cylinder head intake valve guide orifice	φ6+0.015	
14	Exhaust valve stem diameter	φ5.96±0.008	+0.032～+0.063
	Diameter of cylinder head exhaust valve guide orifice	φ6+0.015	
15	Diameter of camshaft first journal	$\varphi 32e6\left(^{-0.050}_{-0.066}\right)$	+0.050～+0.090
	Diameter of cylinder head first bearing hole	Ø32 H7(+0.025 0)	
16	Diameter of camshaft second journal	$\varphi 24e6\left(^{-0.040}_{-0.053}\right)$	+0.040～+0.074
	Diameter of cylinder head second bearing hole	$\varphi 24H7\left(^{+0.021}_{0}\right)$	
17	Diameter of camshaft third journal	$\varphi 24e6\left(^{-0.040}_{-0.053}\right)$	+0.040～

No.	Name	Dimension and tolerance	Fit clearance
	Diameter of cylinder head third bearing hole	$\varphi 24H7\left(^{+0.021}_{0}\right)$	+0.074
18	Diameter of camshaft fourth journal	$\varphi 24e6\left(^{-0.040}_{-0.053}\right)$	+0.040～+0.074
	Diameter of cylinder head fourth bearing hole	$\varphi 24H7\left(^{+0.021}_{0}\right)$	
19	Diameter of camshaft fifth journal	$\varphi 24e6\left(^{-0.040}_{-0.053}\right)$	+0.040～+0.074
	Diameter of cylinder head fifth bearing hole	$\varphi 24H7\left(^{+0.021}_{0}\right)$	
20	Camshaft thrust groove width	$30.65H7\left(^{+0.025}_{0}\right)$	+0.15～+0.20
21	Outside diameter of camshaft oil seal	$\varphi 50^{+0.4}_{+0.2}$	-0.005～-0.40
	Diameter of cylinder head oil seal hole	$\varphi 50H7\left(^{+0.025}_{0}\right)$	
22	Diameter of cylinder head jib hole	$\varphi 12G7\left(^{+0.024}_{+0.006}\right)$	+0.006～+0.035
	Outside diameter of hydraulic jib	φ12-0.011	
23	Diameter of crankshaft timing gear segment	Φ28f7	
	Bore diameter of crankshaft timing gear	φ28＋0.030	
24	Key groove dimension of crankshaft timing gear	$5^{+0.030}$	0~0.06
	Key groove width of crankshaft gear	$5^{+0.030}$	
	Semicircular key width	$5^{0}_{-0.030}$	
25	Bore diameter of crankshaft pulley	$\varphi 74^{+0.046}$	0.096~0.126
26	Outside diameter of timing gear	$\varphi 74^{-0.05}_{-0.08}$	

III. Primary Fit Clearance

Name	Fit Clearance
Axial clearance of crankshaft	0.07～0.265mm
Axial Clearance of Camshaft	0.15～0.20mm
Axial clearance of connecting rod	0.15～0.4mm
Fit clearance of connecting rod bearing	0.023～0.058mm
Fit clearance of main bearing	0.035～0.075mm
Fit clearance between intake valve stem and valve	0.012～0.043mm

guide	
Fit clearance between exhaust valve stem and valve guide	0.032～0.063mm
Fit clearance between hydraulic jib and cylinder head hole	0.006～0.035mm

IV. Engine Primary Tightening Torque Table

No.	Connection part	Part name	Bolt (thread specification)	Number of bolts/ gaskets (piece)	Tightening torque Nm (primary tightening)	Multiple steps tightening (torque + angle)		
						First step tightening torque (Nm)	Second step angle (°)	Third step angle (°)
1	Cylinder block main oil passage screw plug 1	Hexagonal socket head plug	M18×1.5	2	20+5	——	——	——
2	Cylinder block main oil passage screw plug 2	Hexagonal socket head plug	M10×1.5	1	20±3	——	——	——
3	Main bearing cap	Hexagon bolt	M11×1.5	4	——	45±5	180±10	——
4	Main bearing cap	Hexagon bolt	M11×1.5X92.5	6	——	45±5	180±10	——
5	Framework-cylinder block	Hexagon bolt	M8×1.25×55	10	20+3	——	——	——
6	Knock sensor-cylinder block	Hexagonal flange bolt	M8×1.25×35	1	20+0.5	——	——	——
7	Connecting rod cap-connecting rod body	Hexagon bolt	M8×1	8	——	25±3	90±5	——
8	Oil pump assembly-cylinder block	Hexagon bolt	M6×35	4	8+3	——	——	——
9	Engine oil collector bracket, separator-framework	Hexagonal flange bolt	M6×12	9	8+3	——	——	——
10	Bleeding plug-oil pan	Hexagon bolt	M16×1.5	1	25±3	——	——	——
11	Oil pan-framework	Hexagonal flange bolt	M7×20	18	15+3	——	——	——
12	Oil pan-framework	Hexagonal flange bolt	M7×35	3	15+3	——	——	——
13	Oil pan-framework	Hexagonal flange bolt	M7×90	4	15+3	——	——	——
14	Water pump-cylinder block	Hexagon bolt	M6×25	5	8+3	——	——	——
15	Cylinder head oil passage throttle bolt	Hexagon throttle bolt	M14×1.5	2	15+3	——	——	——
16	Camshaft bearing cap-cylinder head	Locating bolt	M6×1×30	18	9.5±1.5	——	——	——
17	Camshaft bearing cap-cylinder head	Hexagonal flange bolt	M6×1x30	2	9.5±1.5	——	——	——

No.	Connection part	Part name	Bolt (thread specification)	Number of bolts/ gaskets (piece)	Tightening torque Nm (primary tightening)	Multiple steps tightening (torque + angle)		
						First step tightening torque (Nm)	Second step angle (°)	Third step angle (°)
18	Phaser control valve-first camshaft cap	Inner hexagonal bolt	M6×1×15	2	8+3	——	——	——
19	Cylinder head-cylinder block	Inner hexagonal bolt	M10×1.5	10	——	50±5		
20	Valve cover assembly-cylinder head	Damping unit-valve cover	M6×1×30	12	8+3	——	——	——
21	Camshaft position sensor-valve cover	Inner hexagonal bolt	M6×1×15	2	8+0.5	——	——	——
22	Hanger-cylinder head	Hexagonal flange bolt	M8×14	2	20+5	——	——	——
23	Rear housing of timing gear-cylinder head	Cross head screw	M5×15	6	5+2	——	——	——
24	Phaser-camshaft	Inner TORX hollow bolt	M12×1.25	2	120±5	——	——	——
	Timing gear-camshaft	Bolt	M12×1.25	2	120±5	——	——	——
25	Inlet cam phaser cap-inlet cam phaser	Hexagon bolt		1	30	——	——	——
26	Exhaust cam phaser cap-exhaust cam phaser	Inner TORX bolt		1	30	——	——	——
27	Oil filter assembly-oil filter seat	Screw sleeve	M20×1.5	1	25±3	——	——	——
29	Oil filter joint		M20×1.5	1	25±3	——	——	——
30	Oil filter seat-cylinder block	Inner hexagonal bolt	M8×25	3	20+5	——	——	——
31	Oil pressure switch-oil filter		M14×1.25×12 （13×13）	1	12±2	——	——	——
32	Thermostat assembly-cylinder head	Hexagon bolt	M6×60	3	8+3	——	——	——
33	Thermostat cover-thermostat case	Hexagonal flange bolt	M6×20	4	8+3	——	——	——
34	Coolant senser-thermostat shell		M12×1.5	1	20+5	——	——	——
35	Crankshaft timing gear-crankshaft	Hexagonal flange bolt	M13×1.5	1	——	130±10	65±5	——
36	Crankshaft pulley-crankshaft timing gear	Hexagonal flange bolt	M8×1×15	6	——	25±5	30±5	——
37	Flywheel-crankshaft	Hexagonal flange bolt	M8×1.25	8	——	15±5	30±5	——
38	Signal wheel-flywheel	Hexagon bolt	M8×1.25	6	8±2	——	——	——
39	Timing belt-tensioner assembly-cylinder block	Hexagonal flange bolt	M8×55	1	27±3	——	——	——
40	Timing belt-idler assembly-cylinder head	Hexagonal flange bolt	M10×60	1	40+5	——	——	——
41	Bulkhead-crankshaft locating pin hole	Hexagonal flange bolt	M16×1.5	1	25±3	——	——	——

No.	Connection part	Part name	Bolt (thread specification)	Number of bolts/ gaskets (piece)	Tightening torque Nm (primary tightening)	Multiple steps tightening (torque + angle)		
						First step tightening torque (Nm)	Second step angle (°)	Third step angle (°)
42	Front lower cover of timing gear-engine	Hexagonal flange bolt	M6×24	5	8+3	——	——	——
43	Front upper cover of timing gear-engine	Inner hexagonal bolt	M6×30	1	8+3	——	——	——
44	Front upper cover of timing gear-engine	Hexagon bolt	M6×16	4	8+3	——	——	——
45	Air compressor bracket-cylinder block	Hexagonal flange bolt	M8×25	1	10+3	——	——	——
46	Air compressor bracket-cylinder block	Hexagonal flange bolt	M8×65	3	30+3	——	——	——
47	Power steering pump-steering pump bracket	Hexagonal flange bolt	M8×125	1	20+5	——	——	——
48	Power steering pump-steering pump bracket	Hexagonal flange bolt	M8×25	1	20+5	——	——	——
49	Power steering pump-steering pump bracket	Hexagonal flange bolt	M8×80	1	20+5	——	——	——
50	A/C compressor assembly-air compressor bracket	Hexagonal flange bolt	M8×100	1	20＋5	——	——	——
51	Air compressor assembly-air compressor bracket	Hexagonal flange bolt 1	M8×30	1	20+5	——	——	——
52	Generator assembly-generator bracket	Hexagonal flange bolt	M10×90	1	30＋5	——	——	——
53	Generator lower bracket-cylinder block	Hexagonal flange bolt	M10×45	2	40＋5	——	——	——
54	Ignition coil assembly-bracket	Hexagon bolt	M6×1×50	4	8+3	——	——	——
55	Spark plug-cylinder head	Hexagon bolt	M14×1.25	4	30+3	——	——	——
56	Intake manifold-cylinder head	Stud bolt	M6×1×25	9	3+2	——	——	——
57	Intake manifold-cylinder head	Hexagon nut	M6	9	8+3	——	——	——
58	Delivery pipe assembly-air intake pipe	Hexagonal flange bolt	M6×20	2	8+3	——	——	——
59	Throttle body assembly-air intake pipe	Hexagon bolt	M6×1×50	4	8+3	——	——	——
60	Bracket-air intake pipe	Hexagon bolt	M8×30	2	20+5	——	——	——
61	Bracket-air intake pipe	Hexagonal flange bolt	M8×40	2	20+5	——	——	——
62	Engine oil dipstick tube-air compressor bracket	Inner hexagonal bolt	M6×16	1	8+3	——	——	——
63	Engine oil dipstick tube-framework	Hexagon bolt	M6×16	1	8+3	——	——	——

No.	Connection part	Part name	Bolt (thread specification)	Number of bolts/ gaskets (piece)	Tightening torque Nm (primary tightening)	Multiple steps tightening (torque + angle)		
						First step tightening torque (Nm)	Second step angle (°)	Third step angle (°)
64	Exhaust manifold-cylinder head	Stud bolt	M8×1×46	9	12+3	——	——	——
65	Exhaust manifold-cylinder head	Hexagon nut	M8	9	20+5	——	——	——
66	Exhaust pipe thermal shield-exhaust pipe	Hexagon bolt	M8×12	3	20+5	——	——	——
67	Oil return pipe bracket-cylinder block	Hexagon bolt	M8×20	1	20+5	——	——	——
68	Oil return pipe hollow screw		M14×1.5	1	15+3	——	——	——
69	Bracket-oil-gas separator	Inner hexagonal bolt	M5×14	2	6+2	——	——	——
70	Bracket-oil-gas separator	Inner hexagonal bolt	M6×14	2	8+3	——	——	——
85	Other		M4		2.5±0.5	——	——	——
			M5		5±1.5	——	——	——
			M6		8±3	——	——	——
			M7		15±3	——	——	——
			M8		20±5	——	——	——
			M10		40±5	——	——	——

V. The Parts where Lubrication are Required during Assembly of Engine

No.	Lubrication parts	Type of lubricant
1	Piston pin and pin hole	SJ10W-40
2	Piston ring groove	SJ10W-40

3	Connecting rod bearing shell and connecting rod journal	SJ10W-40
4	Cylinder sleeve hole	SJ10W-40
5	Main bearing lining and crankshaft main journal	SJ10W-40
6	Crankshaft thrust sheet (at oil groove side) and thrust surface	SJ10W-40
7	Head and thread of connecting rod bolt	SJ10W-40
8	Head and root of main bearing cap bolt	SJ10W-40
9	Rear oil seal edge and crankshaft oil seal journal	SJ10W-40
10	Head and root of cylinder head bolt	SJ10W-40
11	Valve guide orifice	SJ10W-40
12	Valve stem	SJ10W-40
13	Valve oil seal lip	SJ10W-40
14	Valve seat insert	SJ10W-40
15	Valve keeper ring groove	SJ10W-40
16	Cam and journal of camshaft	SJ10W-40
17	Camshaft bearing hole	SJ10W-40
18	External surface and base plane of hydraulic jib	SJ10W-40
19	Hydraulic jib hole and valve rocker arm head	SJ10W-40
20	Outer ring of oil pump	SJ10W-40
21	Edge or journal of camshaft oil seal	SJ10W-40
22	Intake and exhaust phaser control valve gaskets	SJ10W-40
23	Journal of intake and exhaust phaser	SJ10W-40

VI. The Parts where Rubber Coating are Required during Assembly of Engine

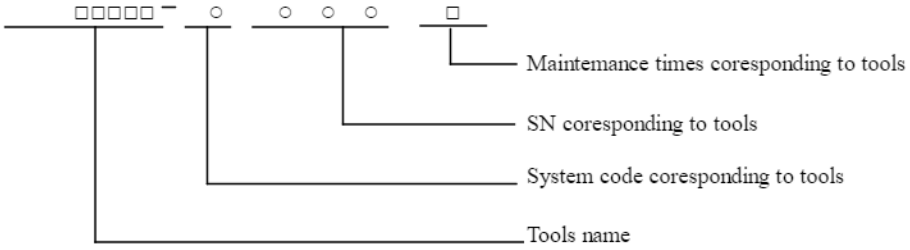
No.	Parts where rubber coating are required	Type of sealant
1	Cylinder block bowl plug	Loctite 648
2	Cylinder block main oil passage plug	Loctite 243
3	Junction plane of framework and cylinder block	Loctite 515
4	Outer ring of crankshaft rear oil seal	Loctite 243
5	Framework and oil pan	Loctite 5910
6	Cylinder head bowl plug	Loctite 648
7	Main oil passage screw plug	Loctite 243
8	Base plane of first bearing cap	Loctite 574
9	Water temperature sensor	Loctite 243
10	Oil pressure switch	Loctite 243
11	Flywheel bolt	Loctite 243
12	Oil pan main oil passage plug	Loctite 243
13	Engine oil collector separator bolt	Loctite 243

Chapter Three Special Tools

Please use the special tools that we designated to perform maintenance, otherwise it will cause accident or damage the machine.

I. Connotation of Special Tool Number

In order to know or find the tool clearly according to parts number and improve maintenance efficiency, special tools numbering is stipulated as follows:



□ indicates a letter ○ indicates an Arabic numeral

Nomenclature of the tool: for a standard part, please use the brand and model recommended by Chery company as reference. For example, CH indicates a non standard part, which means it is a special tool for repair of this part verified by After Sales Service Department of Chery Automobile Sales Co., Ltd. HAZET indicates a standard tool produced by this company.

Connotation of system code corresponding to the tool:

Number	Position
1	Chassis
2	Engine
3	Transmission
4	Accessory
5	Body

Corresponding series number of tools: from 001 to 999.

Times of modifications of the tool:

Number	Modification
A	First modification
B	Second modification
C	Third modification
D	Fourth modification

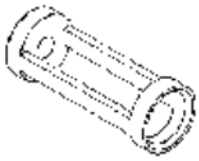
Note: In alphabetical order. Bigger SN means more modification times.

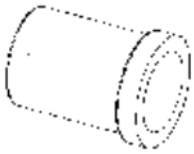
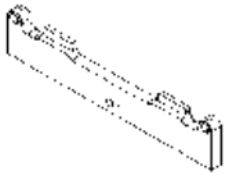
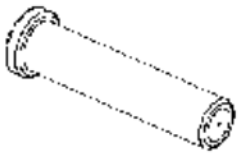
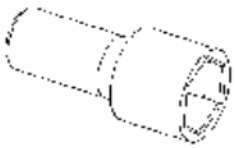
For example: CH-1002A means it is the 2# special tool for repair of chassis system that has been verified by After Sales Service Department of Chery Automobile Sales Co., Ltd., who commits

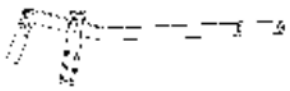
production of this tool to other manufacturer. This tool is of the first modification.

HAZET-6290-1CT means it is a standard tool produced by HAZET company with its model as 6290-1CT.

II. Special Tools Chart

CH-20002 	Installation tool for camshaft oil seal: used to install camshaft oil seal.	Same as A5
CH-20003 	Engine timing tool: used to time crankshaft.	Same as A5
CH-20004 	Adaptor: used to install and remove valve spring (match with Eastar special tool MLR-MD998772A).	Same as A5
CH-20005 	Installation tool for crankshaft rear oil seal: used to install crankshaft rear oil seal.	Same as A5
CH-20006 	Installation handle for crankshaft rear oil seal: used to install crankshaft rear oil seal.	Same as A5
CH-20007 	Installation sleeve for crankshaft front oil seal: used to install crankshaft front oil seal.	Same as A5

CH-20008 	Installation sleeve for crankshaft front oil seal	Same as A5
CH-20009 	Locating tool for flywheel: used to locate flywheel.	Same as A5
CH-20010 	Camshaft timing tool: used to time camshaft.	Same as A5
CH-20011 	Installation tool for camshaft oil seal: used to install camshaft oil seal.	Same as A5
CH-20012 	Valve oil seal guide sleeve: used to install valve oil seal.	Same as A5
CH-20013 	Valve oil seal remover: used to remove valve oil seal.	Same as A5
CH-20015 	Belt pulley bolt remover: used to remove belt pulley clip.	Same as A5

CH-20017 	Installation tool for valve keeper: used to install valve keeper.	Same as A5
CH-20018-A 	Valve spring remover: used to remove valve spring.	Same as A5

Recommended tools

	Loop wheel machine: used to raise engine.
	Engine maintenance workbench: the workbench for disassembly and assembly of engine.
	Fuel pressure gauge: used to measure oil pressure of engine.

	Pressure gauge for cylinder: used to measure cylinder pressure. When measuring, remove spark plug first, screw instrument pipe orifice into the position of spark plug, use starter to drag the engine to rotate, and then fetch the maximum reading of the pressure gauge for cylinder as cylinder pressure of this cylinder.

Chapter Four Measurement of Cylinder Pressure

I. Detection of Cylinder Pressure

Measurement of cylinder pressure is the major index for judgment of engine working condition, through which, we can definitely judge if a certain system of engine works well. Therefore, during maintenance of engine, measurement of cylinder pressure is indispensable.

1. Measuring process

Please select a cylinder pressure gauge with accurate reading and let its pointer return to zero; otherwise, it may affect accuracy of reading.

1.1 Turn off ignition switch, pull out all ignition cables from spark plug side, and then pull out harness connector of injection nozzle.



1.2 Use a spark plug sleeve to loosen the spark plug whose cylinder will be measured. **Explanation:** do not remove the spark plug whose cylinder will not be measured.



1.3 Screw the cylinder pressure gauge joint slowly and vertically into the spark plug hole. Do not screw too tightly for fear that it may be difficult to disassemble.
1.4 Step down clutch pedal, start the engine and let it run for about 5-6s, then fetch the numerical value.

2. Judgment of cylinder pressure value

2.1 Correct cylinder pressure
The standard cylinder pressure value should be 10-13.5bar. With use of engine, this value will fall, but it should not be below 9bar with the pressure difference among cylinders not exceeding 3bar.
2.2 In case cylinder pressure of engine is below the standard value, it indicates deficiency of cylinder pressure, the main cause of which may be untight piston ring seal or valve. Please further analyze and check.

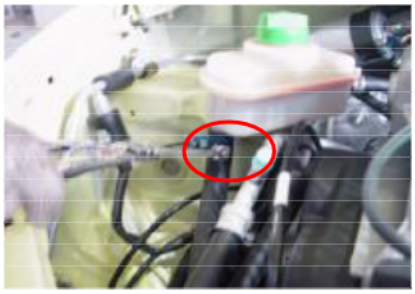


When starting the engine, ensure adequate quantity of electricity. Correct cylinder pressure can only be measured out with revolution of engine as 200-300r/min.

Chapter Five Disassembly of Power-assisted Steering System

I. Disassembly Procedure

1. Use a snap ring pliers to loosen the clamp on connecting hose of steering fluid reservoir and steering pump. Use a clean container to reclaim the steering fluid.



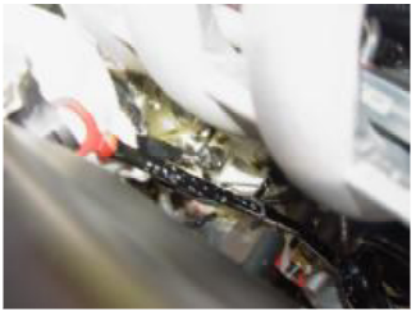
2. Use a 21# sleeve to remove the fixing bolt of steering pump oil pipe.
Torque: 20+5Nm.



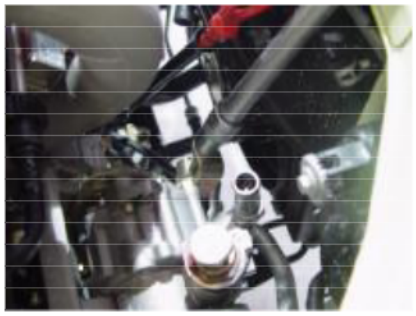
3. Use a 10# sleeve to loosen the (upper) fixing bolt of steering pump adjusting bracket.
Torque: 20+5Nm.



4. Use a 10# sleeve to loosen the (lower) fixing bolt of steering pump adjusting bracket.
Torque: 20+5Nm.



5. Use a 10# open end wrench to loosen the adjusting bolt of steering pump bracket, and then pull the steering pump upwards to loosen and take off the belt.



6. Use a 10# sleeve to loosen the connecting bolt of steering pump and compressor bracket, pull out harness connector, and then dismount the steering pump assembly.



Note: when dismounting the steering pump, please block the oil pipe joint with clean cotton cloth.

II. Overhaul

Steering pump can not be repair, if such failure as abnormal noise or oil leak exists, replace the assembly.

III. Installation of the Steering Pump

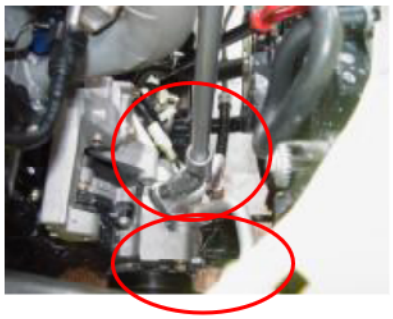
1. Follow the order adverse to that of disassembly to install.
2. After installation of steering oil pump, duly adjust tightness of belt through adjusting bolt.
3. After power steering pump is properly installed, refill with special steering pump oil, and then bleed air for the power steering pump after the engine starts.
4. Air bleeding method:
4.1 Hoist the vehicle to let its front wheels leave ground.
4.2 Turn the steering wheel left and right to the ends (duration for each time should not exceed 5s, otherwise, the power steering pump is likely to be burnt out) until the oil pump does not make sound. Note that oil storage kettle should not be lack of steering pump oil.

Chapter Six Disassembly of A/C Compressor

I. Disassembly Procedure

Before disassembling the compressor, disassemble the steering oil pump first.

1. Use a 12# sleeve and a universal joint connecting rod to loosen the connecting bolt of A/C high and low pressure pipelines. (**Note:** if there is R134a in the condenser, use a special equipment to reclaim first.)



After the pipeline is loosened, immediately block high and low pressure holes of the compressor with clean cotton cloth to avoid entry of foreign material into the compressor!

2. Hoist the vehicle and then use a 13# sleeve to loosen the fixing bolt of the compressor from underside.
Torque: 20+5Nm.



3. Lower the vehicle and then use a 13# sleeve to loosen the fixing bolt of the compressor from upside. Use a 13# sleeve to loosen the fixing bolt at middle of the compressor, and then dismount the compressor assembly.
Torque: 20+5Nm.



II. Overhaul of Compressor

Inside of the compressor are assembled with highly machined fine parts, in case abnormal noise or internal failure is found, replace the assembly.

III. Installation procedure

For the installation order, please refer to the disassembly order, and then follow the order adverse to that for disassembly to install. It should be noted that, when installing the A/C pipeline joint on the compressor, be sure to replace with a new gasket and tight the joint at specified torque to avoid leak.

Chapter Seven Disassembly of Generator

I. Disassembly Procedure

Before disassembling the generator, remove the connecting line of battery first.

1. Use a 10# sleeve to remove the connecting line of battery.



2. Use a 10# sleeve to loosen the fixing bolt of generator adjusting bracket, and then take off the adjusting bracket. Torque: 30+5Nm.



3. Use a 13# sleeve to remove lower fixing bolt of the generator.
Torque: 40+5Nm.



4. Use a 10# sleeve to remove the fixing bolt of generator anode harness, pull out the harness connector, remove the belt and then take out the generator.



II. Overhaul of Generator

In case the generator makes abnormal noise or its yield is too high or too low, replace the assembly.

III. Installation Procedure

The installation order of the generator is adverse to that for its disassembly. After the generator is installed, adjust deflection of the belt.

Chapter Eight Replacement of Engine Timing Belt

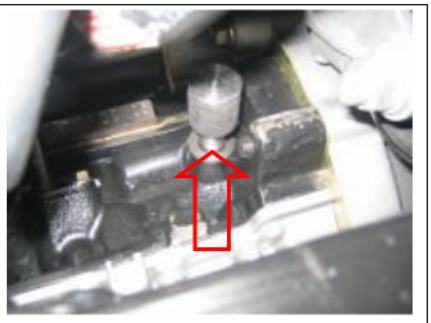
I. Disassembly Procedure

In order to ensure normal and highly effective working of the engine, replacing the timing belt at 50,000km mileage is recommended.

1. Disassembly of engine timing belt:

1.1 Follow the disassembly methods for power-assisted steering pump, compressor and generator to disassemble the generator and compressor belt.

1.2 Use a 5mm hexagon wrench to remove the five fixing bolts on timing upper cover.	
1.3 The positions of the five fixing bolts on timing upper cover are shown by the red circles in the figure.	
1.4 Use a 13# sleeve to loosen the crankshaft timing adjusting hole bolt. (The adjusting bolt is at upside of the starter)	

1.5 Insert the special tool CH-20003 into the timing hole and tighten, use a wrench to turn the big nut in the crankshaft pulley to make the crankshaft rotate, at the same time, slowly screw in CH-20003 until the crankshaft can not rotate back and forth any longer.	
1.6 Use a 13# sleeve to remove the six fixing bolts of crankshaft pulley and take out the crankshaft pulley. Torque: 55+5 Nm.	
1.7 Use a 10# sleeve to remove the six fixing bolts on timing lower cover.	
1.8 The positions of the six fixing bolts on timing lower cover are shown by the red circles in the figure.	
1.9 It should be specially explained that, the position of the fixing bolt at left upside on the lower cover is very occult, for removal of which, use of universal joint connecting rod is required. Alternatively, use a 13mm sleeve to remove the three bolts of suspension bracket to take off the suspension bracket.	

1.10 Use a 10# sleeve to loosen the fixing bolt of the tension pulley to take off the timing belt.
Torque: 27±3 Nm.

Note:
when taking off the timing belt, pay attention to running direction of the belt and refer to running direction of the engine crankshaft and the arrowhead direction on the belt.

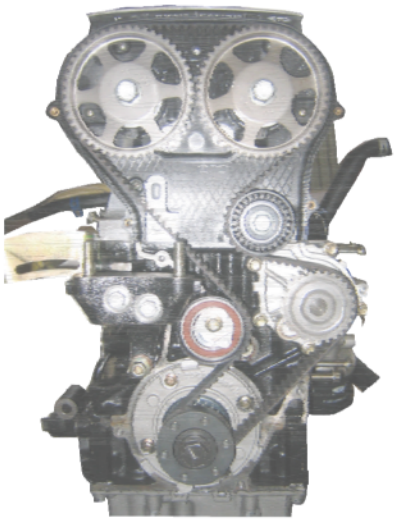


II. Installation of Timing Belt

1. Loosen the fixing bolt of tension pulley and turn the tension pulley to minimum tension position.
2. Install the belt.
3. Use a 5mm hexagon wrench to turn the tension pulley, when it turns to a position that the hexagon wrench and the fixing bolt are roughly on the same horizontal line, stop and tighten the fixing bolt.
4. Install timing lower cover.
5. Install crankshaft pulley.
6. Install relevant accessories and check deflection of the belt.
7. Install timing upper cover.
8. The installed timing belt is as shown in the figure.



Note:
During the disassembly process, be not to turn crankshaft/camshaft; otherwise, ignition timing will need re-check.



III. Adjustment of Timing (general overhaul)

1. Turn the crankshaft to make the four pistons align on a horizontal line in the cylinders, screw the special tool into the crankshaft timing adjusting hole at left rear of the cylinder (last segment of the crankshaft), and then make the crankshaft unable to turn left and right (the bolt of the special tool must enter into the screw hole plane of the cylinder).
2. After intake and exhaust camshaft is installed properly, install the camshaft timing gear, turn the groove at tail of intake and exhaust camshaft to horizontal direction, and then insert the special tool into the groove and fix.
3. After crankshaft and camshaft have been fixed according to requirements, install timing belt. In order to facilitate installation of timing belt, temporarily do not tighten the bolt fixing the timing gear onto camshaft and let it rotate freely, then fix the timing gear bolt after the tensioner pulley has fastened the timing belt to the specified value. After that, install other parts.

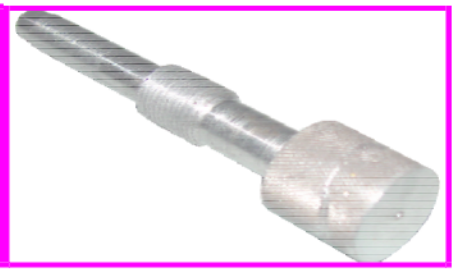
IV. Adjustment of Timing (minor overhaul)

Replace valve spring, grind valve and replace camshaft (do not raise the engine).

1. Remove the valve cover.
2. Remove the timing gear cover. Turn the timing gear.
3. Let the groove at tail of intake and exhaust camshaft on a horizontal line, then insert the projecting portion of the special tool into the groove and fix.
4. Turn the crankshaft, screw the special tool into the crankshaft timing adjusting hole at left rear of the cylinder (last segment of the crankshaft), and then make the crankshaft unable to turn left and right (if the cylinder head is removed, it can be found that the pistons of the four cylinders now align at a horizontal position).
5. Install timing belt and make tightness of the belt conform to requirements.
6. Fasten the fixing bolt of timing gear.
7. Install other accessories, such as timing cover and belt pulley etc.



Special tool for camshaft timing check (CH-20010)



Special tool for crankshaft timing check (CH-20003)

Chapter Nine Disassembly of Engine Assembly

I. Disassembly Procedure

Note:

Please use regular equipment, especially for such equipment as crane etc., so as to avoid occurrence of accident.

Before any disassembly job, disassemble cathode of battery first, so as to protect safety of electricity consumption equipment.

When disassembling engine suspension, pay attention to disassembly order, so as to avoid occurrence of accident.

1. Disassembly of engine wire harness

1.1 Pull out the connecting plug of engine wire harness.



1.2 Use a 10# sleeve to loosen the fixing bolt of engine ground.



2. Use a 10# sleeve to remove the fixing bolt and bearer of battery.



3. Use a 13# sleeve to remove the bolt of battery support fixed mount.



4. Disassembly of cooling system.

4.1 Hoist the vehicle, place away a coolant collector, unscrew bleeder bolt of the water tank to discharge the coolant.



4.2 Use the snap ring pliers to loosen the clamp on connecting pipe of water tank.



4.3 Use the snap ring pliers to loosen the connecting water pipe of A/C heating water tank.

4.4 Use the snap ring pliers to loosen other connecting water pipes.



5. Disassembly and installation of water pump assembly:

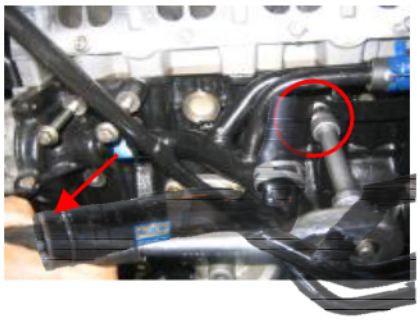
5.1 Remove upper and lower covers of timing gear (refer to disassembly and installation of gear and belt of timing gear).

5.2 Use a caliper to take off the clamps on the three discharging tubes and then pull out the rubber hoses.



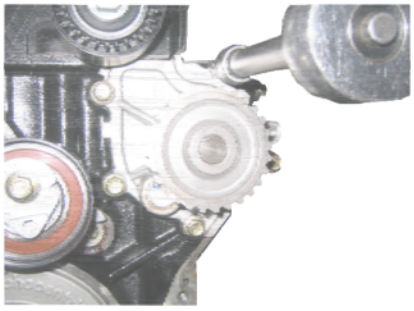
5.3 Use a 10mm sleeve to remove the fixing bolt of discharging tube of water pump and then pull out the discharging tube.

Note: in case the O-ring on discharging tube of water pump is loose, broken or aging, be sure to replace.



5.4 Use a 10mm sleeve to remove the fixing bolt of water pump and then take out the water pump assembly; when removing, be careful not to damage cushion of the water pump, if damaged, replace with a new one. The water pump can not be decomposed to maintain.

5.5 Check water seal of the water pump for water leak; if water pump bearing is loose, replace the assembly. Follow the order adverse to that for disassembly of the water pump to install it.



5.6 Disassembly and installation of thermostat

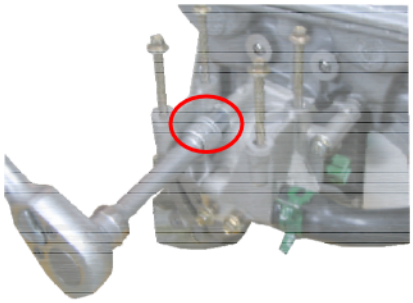
5.7 Use a caliper to take off the clamps on the two discharging tubes and then pull out the rubber hoses.



5.8 Use a 10mm sleeve to remove the fixing bolt of thermostat cover and then take out the thermostat.



5.9 Use a 10mm socket wrench to remove the thermostat seat. Be careful not to damage the thin sheet gasket.



6. Inspection of thermostat:



(1) Under normal temperature, inspect seating status of the valve and it should tightly seat.

(2) Inspect opening temperature and maximum stroke of the valve.

Opening temperature of the valve is 87±2℃

Maximum stroke of the valve is 8mm

Full opening temperature of the valve is 104℃

(3) Then check if the valve closes at the temperature 5℃ lower than the opening temperature. If not compliant, replacement with a new thermostat is required. Follow the order adverse to that for disassembly of the thermostat to install it. When installing, check if the gasket of the thermostat is damaged, if thermostat seat and thermostat cover casing plane are satisfactory. Check the sealing gasket for damage, if damaged, replace with new sealing element.

7. Disassembly of A/C pipeline

See **Disassembly of A/C Compressor** for disassembly of A/C pipeline.

8. Disassembly of power-assisted steering pipeline.

See **Disassembly of Power-assisted Steering Oil Pump** for disassembly of power-assisted steering pipeline.

9. Disassembly of intake and exhaust manifold.

9.1 Use a 10# sleeve to remove the fixing bolt of air intake pipe.



9.2 Use a cross-head screwdriver to loosen the clamp connecting intake hose and electronic throttle body.



9.3 Use a 13# sleeve to remove the connecting bolt of three-way catalytic converter and exhaust intermediate pipe.
Torque: 60±5 Nm.



9.4 Use a 10# sleeve to remove heat insulating mattress of exhaust pipe.



9.5 Use a 13# sleeve to remove the connecting bolt of exhaust manifold and three-way catalytic converter.
Torque: 60±5 Nm.



9.6 Use a 13# sleeve to remove the fixing bolt of exhaust manifold.



10. Disassembly of connecting portion of transmission case.
10.1 Use pliers to remove the fixing steel wire clip of gearshift control cable.



10.2 Use pliers to remove the fixing clip of gearshift control cable outer case and then take off the gearshift control cable.



10.3 Use a 13# sleeve to loosen the adjusting screw of clutch control cable and then take off the clutch control cable.



10.4 Use a 13# sleeve to loosen the fixing bolt of clutch control cable on the transmission case.



10.5 Use a 17# wrench to loosen the bleeding bolt of transmission case to discharge the gear oil.

10.6 See **Service Manual for Chassis** for disassembly of suspension travel portion.

10.7 Use a crow to pry out the half shaft.

11. Disassembly of suspension portion

11.1 Use a 13# sleeve to remove the fixing bolt for rear engine mount bracket of transmission case.

Torque: 60±5Nm.



11.2 Use a 18# sleeve to loosen the fixing bolt for front engine mount bracket.
Torque: 80±5 Nm.



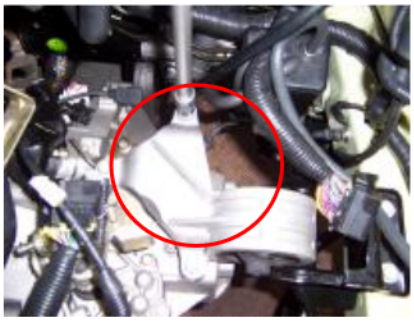
11.3 Use a crane to hoist the engine until the iron chain just bears tensile force.



11.4 Use a 15# sleeve to loosen the fixing bolt for right engine mount bracket. (at rear of transmission)
Torque: 100±5 Nm.



11.5 Use a 13# sleeve to loosen the three connecting bolts for right engine mount bracket.
Torque: 65±5Nm.



11.6 Use a 13# sleeve to loosen the three connecting bolts for left engine mount bracket.
11.7 Pull out oil pipe connector and junctions of relevant pipelines. Make sure that relevant junction parts have all detached.
11.8 Hoist the engine up.



12. Separation of transmission case assembly and engine

12.1 Use a 10# sleeve to remove the gearshift control cable bracket on the transmission case.



12.2 Use a 13# sleeve to loosen the four fixing bolts for front engine mount bracket.

Torque: 65±5Nm.



12.3 Use a 13# sleeve to remove the connecting bolt of transmission case and engine, and then make the engine and the transmission separate.

Torque: 100±10 Nm.



II. Installation Procedure

1. Please follow the order adverse to that for disassembly to install, but care should be taken for the following matters.

(1) When hoisting, do not install exhaust manifold first, because the longitudinal separation of engine compartment is not big enough; otherwise, it may affect the assembly.

(2) After installation, please adjust the stroke of clutch pedal. When adjusting, adjust it to a proper position according to the corresponding requirements, in case of a too big free stroke of clutch, it may make sound when shifting gear or fail to release; while in case of a too small stroke, wear of friction plate may be accelerated and travel weakness may occur, if severely, the friction plate may be burnt out.

Chapter Ten Disassembly of Intake Manifold

I. Disassembly Procedure

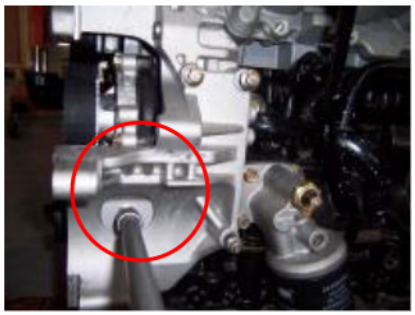
1. Use an 8# sleeve to remove the four fixing bolts of ignition coil and then remove such connections as ignition cable/injection nozzle harness etc.



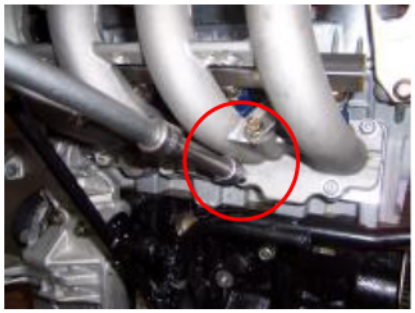
2 Use a 10# sleeve to remove the bolt of intake manifold fixing bracket.



3. Use a 10# sleeve to remove the fixing bolt of compressor bracket.
Torque: 30±3 Nm.



4 Use a 10# sleeve to remove the fixing bolt of intake manifold and then take off the intake manifold assembly.
Torque: 8+3Nm.



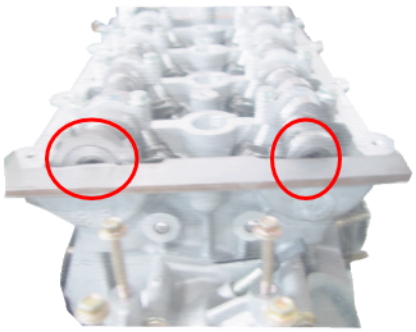
Chapter Eleven Disassembly of Cylinder Head

I. Disassembly Procedure

1 Use a 10# sleeve to remove the fixing bolt of valve cover.
Torque: 8±3 Nm.



2. Get the special tool CH-20010 stuck into the groove on camshaft.



3. Use a 18# sleeve to loosen the fixing bolt of camshaft timing gear.
Torque: 120±5Nm.

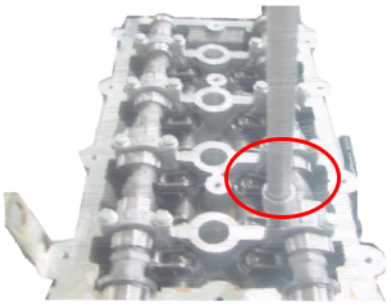


Note:
There is no difference between intake camshaft and exhaust camshaft, they can be interchanged.

4. Use a cross-head screwdriver to loosen the fixing bolt on inner fender of timing gear and then take out the inner fender of timing gear.

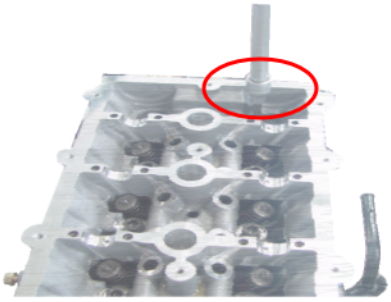


5. Use a 10# sleeve to remove the fixing bolt of camshaft bearing, take out the camshaft assembly and then the hydraulic tappet system.
Torque: 9.5±1.5 Nm.

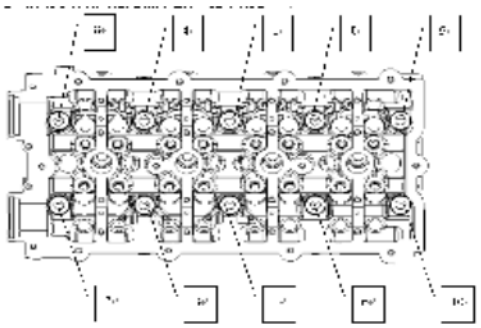


Note:
The positions of both camshaft bearing and bolts, including the order of camshaft bearing, are unchangeable, and should be conformity with the marks during assembly/disassembly.

6. Use an hexagon torque wrench to loosen the fixing bolt of cylinder head and then take off the cylinder head assembly.
Torque: 50±5 Nm.

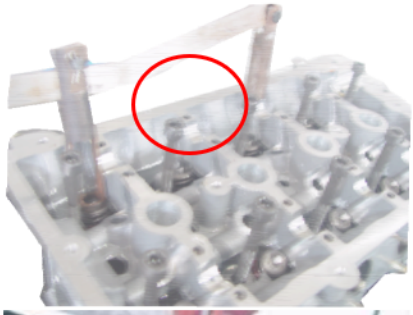


Note:
Follow the order as shown in the figure to loosen the fixing bolts of cylinder head.



7. Disassembly of valve

7.1 Use a special tool to press down the valve spring, take out the locking plate, and then take off valve spring, valve and valve seat insert.



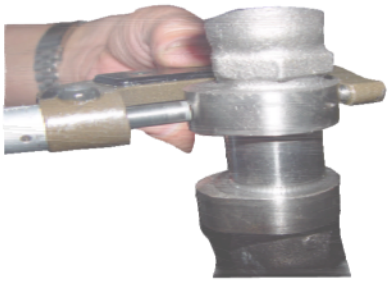
7.2 Use a special tool to pull out the valve oil seal.



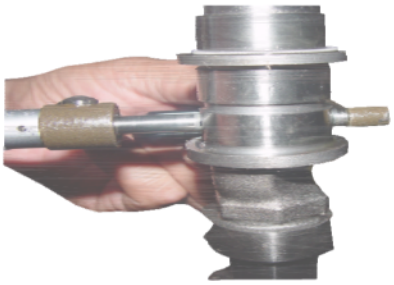
II. Overhaul of Cylinder Head System

1. Detection of camshaft

1.1 Measurement of height of cam. Use an outside micrometer to measure wheel height of the cam.
Wheel height of the intake camshaft: 37.11mm.
Wheel height of the exhaust camshaft: 37.09mm.

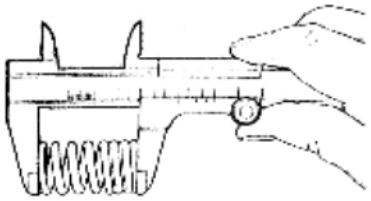


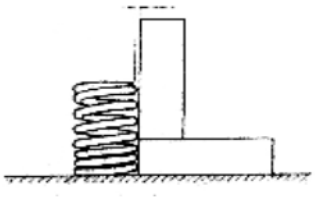
1.2 Inspection of camshaft journal. Use an outside micrometer to measure each journal of the camshaft, please see **Specification Table** for specific data.



2. Detection of valve

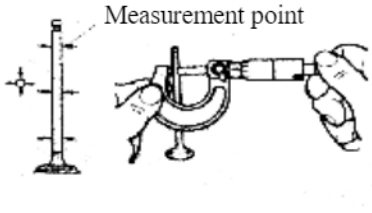
2.1 Detection of valve spring. Two items of data of valve spring should be measured.
Length of the spring: 49mm
Squareness of the spring: 1.2mm (limit)





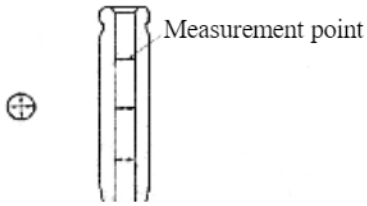
2.2. Detection of valve.

2.2.1 Measurement of diameter of valve stem



2.2.2 Measurement of valve guide inside diameter

Use an inside micrometer to measure inside diameter of the guide.



Note:

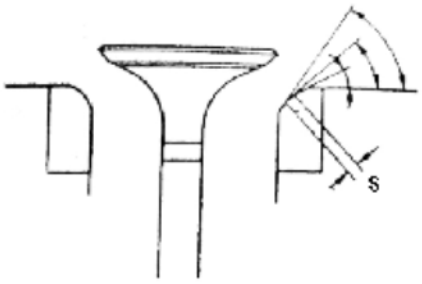
If abnormal noise is generated due to serious wear of valve guide, do not replace the valve guide, because the assembly technique requirements to valve guide is very strict; please replace the cylinder head assembly.

Fit clearance between intake valve stem and valve guide: 0.012~0.043mm

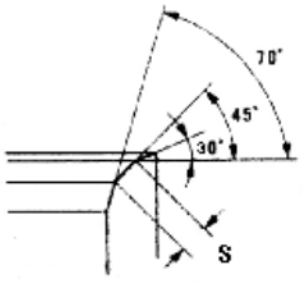
Fit clearance between exhaust valve stem and valve guide: 0.032~0.063mm

2.3 Boring and grinding valve seat insert

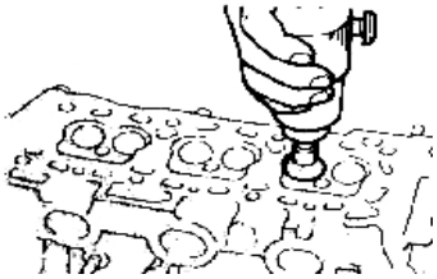
2.3.1 Inspection of fitting surface of valve. Apply a circle of red lead on the valve sealing strip and then gently place the strip onto the valve seat insert, softly and forcibly press it down, but do not turn it. Take out the valve, observe if there is broken part on the red lead, if any, boring and grinding the valve seat insert is required.



2.3.2 Select an appropriate reamer, use 45° conical surface as cooperate standard value to check valve cooperation position: the optimal position is the center of the valve, if not so, be sure to revise. Cut on the conical surface 70° inward and 30° outward at the center of the cooperation position.

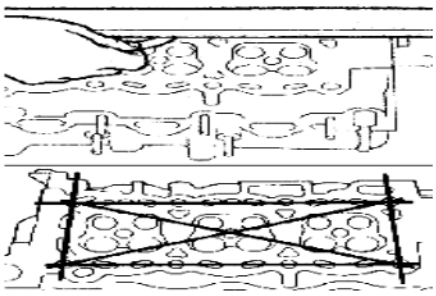


2.3.3 Perform seat grinding for the valve sealing strip with polishing compound



2.3.4 Detection of planeness of cylinder head

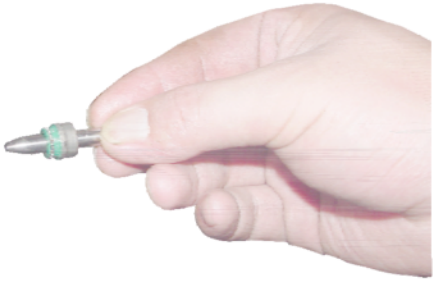
Follow the method as shown in the figure to measure planeness of the cylinder head with a feeler gauge; the planeness of the cylinder should not exceed 0.05-0.10mm, if exceeding this valve, replace the cylinder head assembly.



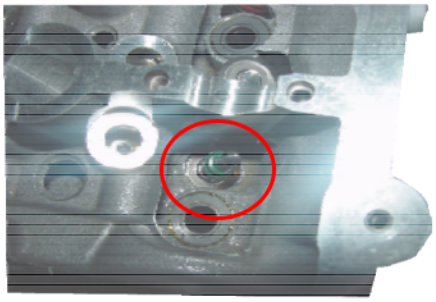
III. Assembly of Cylinder Head Assembly

1. Please follow the order adverse to that for disassembly of cylinder head to install, but care should be taken for the following matters during installation.

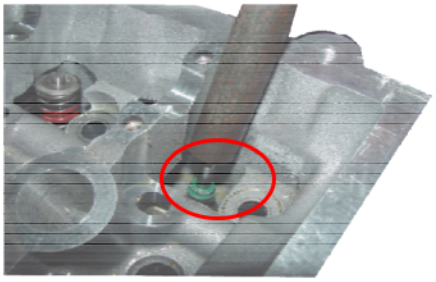
2. Use the special tool CH-20012 to install new valve oil seal onto the guide first.



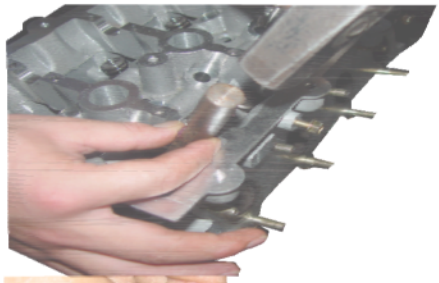
3. Insert big end of the guide onto the valve guide.



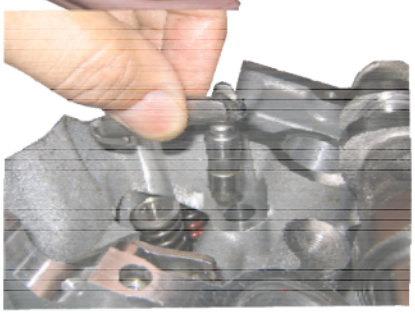
4. Envelope the special tool onto CH-20012, and then softly and forcibly compact.



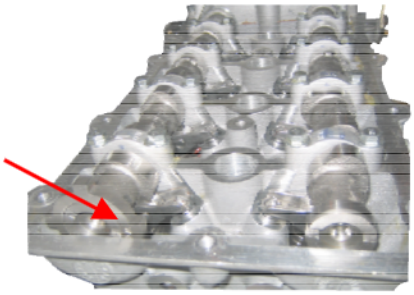
5. Use a hammer to knock the valve oil seal installation tool, when a metal crash sound is heard, take out CH-20012.



6. The methods for installation and assembly of valve spring are the same. Then install valve, spring, keeper, top barrel and rocker arm. (when installing the top barrel, add a little engine oil into the hole).



7. Install camshaft and camshaft bearing shell cover assembly.



Note:

When installing, remember to differentiate intake camshaft from exhaust cam. The intake camshaft has a gear at tail, and pay attention to the diacritical marks on camshaft bearing shell covers.

8. Installation of camshaft and oil seal

8.1 After adding engine oil on the camshaft bearing shell, place intake and exhaust camshafts, cover bearing shell covers properly, install the fixing bolts for the bearing shell covers, and then use a 10mm sleeve to hold down the bearing shell covers step by step (the two bolts on the one and the same bearing shell cover should be tightened at the same time). Torque: 8.5±1.5 Nm.



9. Remember to apply sealant to the position as shown in the figure when installing the first bearing shell.



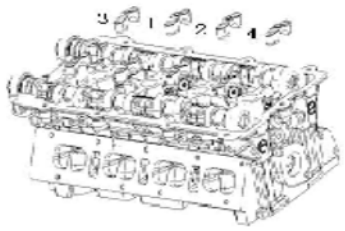
10. Tightening order of camshaft bearing shell cover.

Tighten the camshaft bearing shell cover as shown in the figure.

Installation of camshaft oil seal:

Apply a little engine oil on the camshaft oil seal, envelop the oil seal onto the camshaft, and then

install use the special tool.



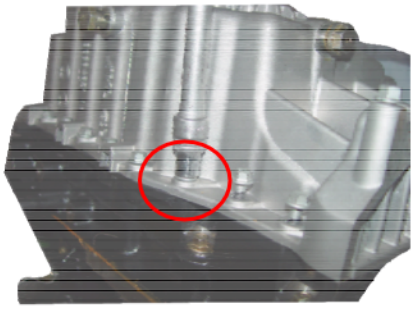
11. Remember to check elasticity of valve cover gasket for aging and breakdown, if any, replace with new one. When installing, pay attention to installation position.

12. Tighten the valve cover bolt.

Chapter Twelve Disassembly and Installation of Oil Pump and Lubrication System

I. Disassembly Procedure

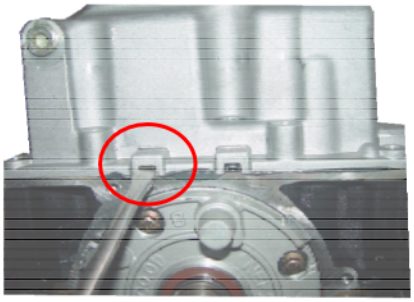
1. Roll over the engine and use a 10# sleeve to remove the fixing bolt of oil pan.
Torque: 15+3 Nm



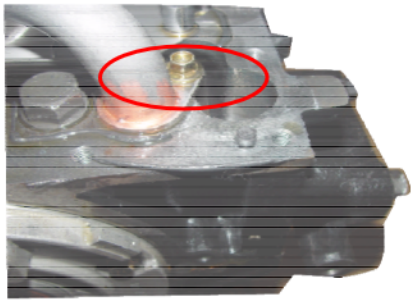
2. Use a screwdriver to pry out the oil pan at the given position for prying out on the oil pan.

Note:

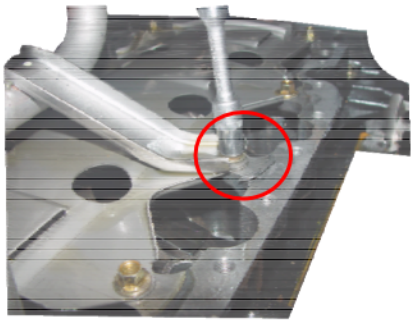
Because the oil pan and cylinder block are sealed with glue, so, do not knock with such hard articles as hammer etc. when disassembling, use a rubber hammer to slowly strike at left and right instead.



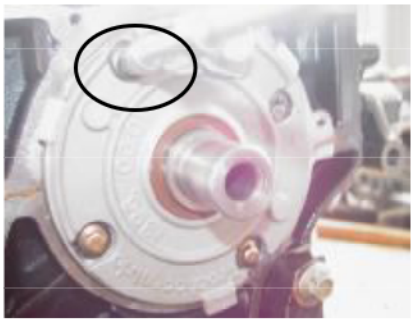
3. Use a 10# sleeve to remove the fixing bolt of engine oil strainer.



4. Use an 8# sleeve to remove the fixing bolt of engine oil guard board.

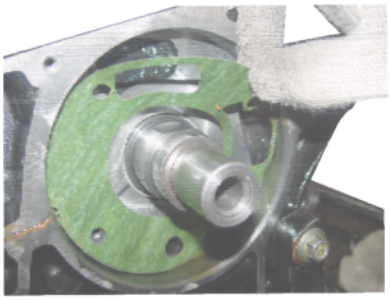


5. Use an 8# sleeve to remove the four fixing bolts of oil pump.
Torque: 8+3Nm

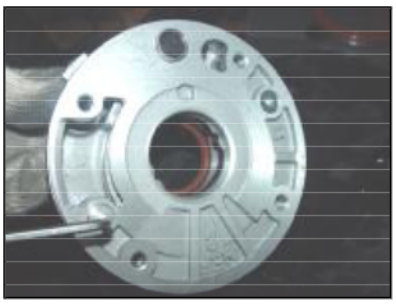


6. Take off the oil pump assembly and then the oil pump shim.

Note:
Do not split the oil pump shim forcibly when disassembling for fear to cause leak.



7. Use an hexagon wrench to remove the two connecting bolts of oil pump.

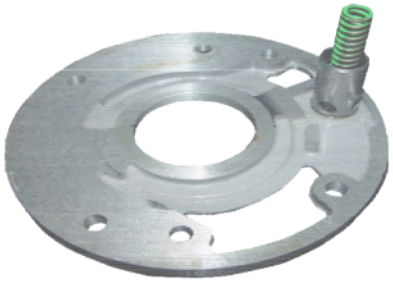


8. Use a screwdriver to pry the crankshaft front oil seal and then take out the oil seal.



II. Overhaul of Oil Pump

if it is suspected that engine oil pressure may has problem, disassemble the oil pump and check elastic force of relief valve spring and if the valve is locked.



Note:

The oil pump is of inner rotor type, which can not be maintained under normal conditions, because its finish size and material ensure its reliability.



III. Installation Procedure

The installation order is adverse to that for disassembly, but care should be taken for the following matters.

1. The installation direction of oil pump relief valve is as shown in the figure.



2. Completely and softly shovel off the glue on the surface of oil pan with a flat shovel and then apply new sealant uniformly (see the table above for type of the sealant).

Note:

As soon as new sealant is applied properly, assemble at once; otherwise, the sealant may freeze, which may affect the sealing effect.

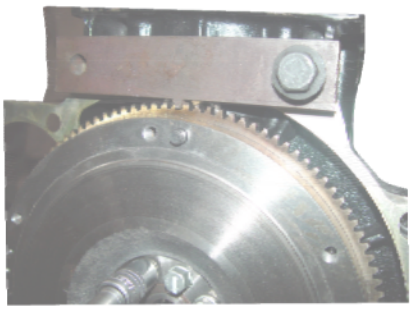
Chapter Thirteen Disassembly of Crank-Connecting Rod Mechanism

I. Disassembly Procedure

1 Use a 13# sleeve to remove the fixing bolt of clutch cover.
Torque: 23±2 Nm

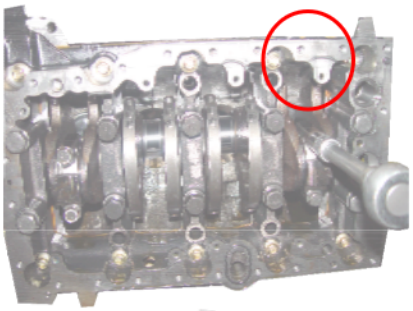


2. Use the special tool CH-20009 to lock the crankshaft and then use a 13# sleeve to remove the connecting bolt of flywheel and crankshaft.

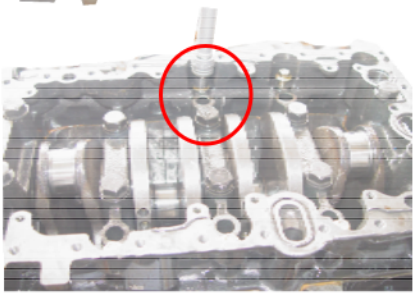


3. Use a 13# sleeve to loosen the fixing bolt of connecting rod bearing cylinder by cylinder and then t[illegible] f the piston and connecting rod assembly.

Note:
After the pistons are taken out of the cylinders, reset and connect the bearing caps of connecting rod big end and bolts properly and then put them by order.



4. Use a 10# sleeve to remove the fixing bolt of crankshaft lower bearing cap and cylinder block.



5. Use a 19# sleeve to remove the fixing bolt of crankshaft main bearing cap.



Note:

The surface between cylinder block and bearing cap is ensured by high precision machining plane, so, do not use any hard article to scuff this surface.

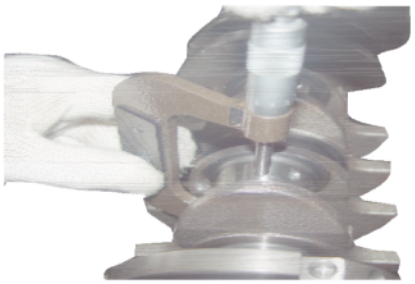
6. Take off crankshaft rear oil seal assembly, remove bearing shell cover, and then take off crankshaft assembly.

II. Overhaul of Crank-Connecting Rod System

1. Detection of crankshaft.

1.1 Detection of crankshaft main journal: use an outside micrometer to measure main journal of crankshaft and the normal value should be 46.01mm.

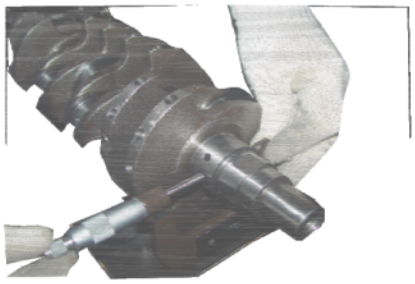
1.2 Detection of connecting rod journal: use an outside micrometer to measure connecting rod journal of crankshaft and the normal value should be 44.485-44.495mm.



1.3 Measurement of main journal clearance: place a plastic feeler gauge on the crankshaft main journal, tighten the main bearing shell cover to specified torque and then loosen it, use the thickness check list on the plastic feeler gauge to read the value. The normal value should be: 0.02-0.06mm. Use the same method to measure connecting rod journal clearance.



1.4 Measurement of crankshaft axial clearance: tighten the main bearing shell cover to specified torque and then use a dial gauge to measure the crankshaft axial clearance. When measuring, push the crankshaft off the dial gauge first and keep the dial gauge has certain amount of compression, set the pointer to zero, and then push the crankshaft to the adverse direction and the numerical value fetched from the dial gauge will be the crankshaft axial clearance. The normal value should be 0.02-0.30mm. If exceeding this scope, replace the crankshaft thrust sheet or the crankshaft.



2. Detection of piston

2.1 Detection of piston diameter: use an outside micrometer to measure the piston diameter. When measuring, remember to measure at the place about 11mm up from lower end of the piston. The normal value should be φ72.965±0.009.



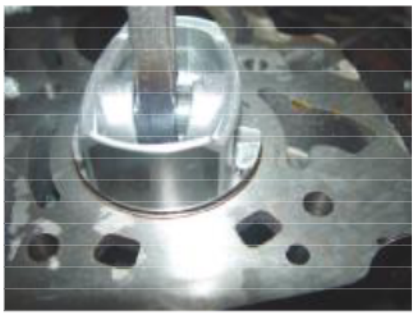
2.2 The piston pin is of semi-floating type, which can not be disassembled during maintenance, because it can not be assembled using common machining technique after disassembled. If abnormal noise occurs due to improper piston pin clearance, replace the piston assembly.

2.3 Measurement of piston ring.

2.3.1 Measurement of piston ring end play: first, place the piston ring into cylinder.



2.3.2 Push the piston head vertically against the piston ring in the cylinder and let the piston ring be on a plane.



2.3.3 Use a feeler gauge to measure the gap between piston ring ends and the normal value should be: 0.2mm.



2.3.4 Measurement of piston ring side clearance: place the removed piston ring into the ring groove (lean to one side as possible) and then place a feeler gauge into the other side to measure the clearance; certain resistance feeling after the feeler gauge is placed in indicates that the measurement with feeler gauge will be correct. The normal value should be 0.03mm. Unit: mm



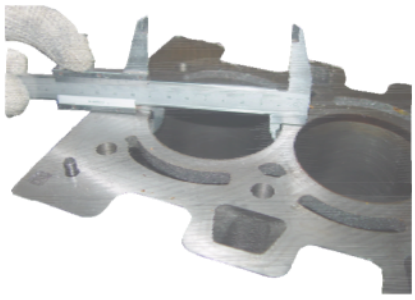
Contents	First ring	Second ring	Third ring
End play	0.2	0.4	/
Side clearance	0.03	0.03	/
Thickness	1.2	1.6	/

3. Measurement of roundness and cylindricity of cylinder

3.1 Select appropriate cylinder gauge and outside micrometer.



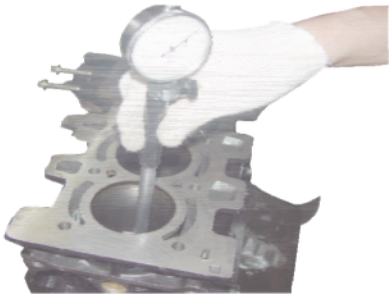
3.2 Use a vernier caliper to measure rough diameter of the cylinder hole.



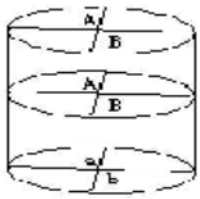
3.3 Adjust the outside micrometer to the data measured out by the vernier caliper, select the splicing pole suitable to the range of the cylinder gauge, and then set the outside micrometer to zero according to this data.



3.4 Place the cylinder gauge into the cylinder to measure; when measuring, the yawing angle of cylinder gauge should not exceed 15°. Fetch the maximum numerical value.



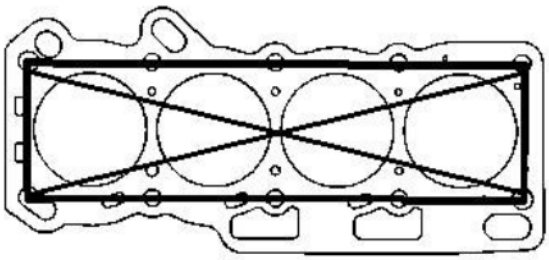
3.5 The measuring position of the cylinder gauge in cylinder is as shown in the figure.
Calculation method for roundness: A-B or a-b
Calculation method for cylindricity: the difference of maximum diameter subtracting minimum diameter among A, a, B, and b.
The normal value should be: if roundness or cylindricity exceeds the range, replace with new cylinder block or install new cylinder sleeve.



Upper stop position of piston

Lower stop position of piston

3.6 Measurement of planeness of cylinder block: use steel rule and feeler gauge to measure planeness of the cylinder block. If the planeness exceeds the range, replace the cylinder block.



III. Installation of Crank-Connecting Rod System

The installation order is adverse to that for disassembly, but care should be taken for the following matters. 1. Installation of crankshaft thrust sheet.
When installing the crankshaft thrust sheet, leave the side with oil groove outwards.



2. Installation of crankshaft front oil seal
2.1 Clear smudge on oil seal seat ring, and then apply a layer of lubricant on the seat ring.
2.2 Apply a layer of engine lubricant on the oil seal lip.



2.3 Enclose the new oil seal with lubricant applied into the special tool. Press the special tool against the oil seal seat ring and softly strike to compact.

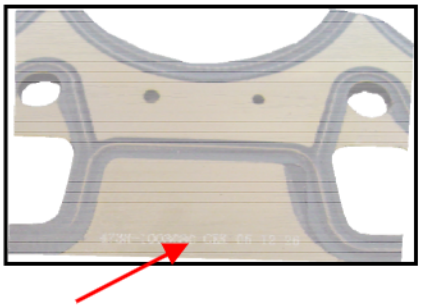


3. Installation of crankshaft rear oil seal
3.1 Clean the oil seal seat ring. Dip engine oil with a piece of gauze and then use it to clear the impurities inside the oil seal seat ring.
3.2 Apply a layer of engine oil uniformly on crankshaft rear oil seal lip and a little engine oil uniformly on outer ring of oil seal. Envelope the oil seal onto the special tool and then press it into the oil seal seat ring.





4. When installing cylinder cushion, install it with the side with word up.



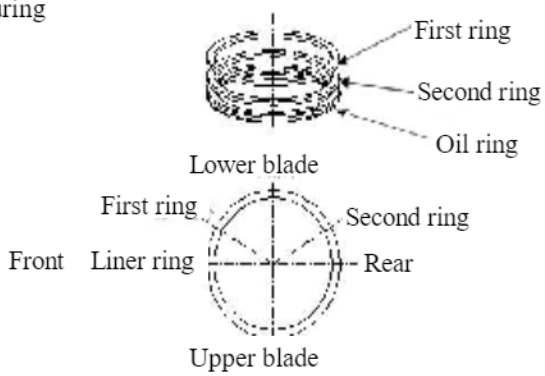
Note:

The cylinder cushion has been applied with sealant, so, providing that the cylinder head or cylinder block has been disassembled, be sure to replace the cylinder cushion.

5. When installing piston ring, remember to leave the side of the second ring with word up.



6. The opening position of the piston ring during installation is as shown in the figure.



7. The label on piston head prompts direction and position of installation.

8. Use a special tool to install the piston ring.



9. When installing connecting rod bearing shell, pay attention to installation mark.



10. Method for shell matching.



Note:

The machining technique for connecting rod and connecting rod shell cap adopts Instantly Swell and Break machining method, so, each machined surface maintains the shape of original material. When installing, keep any sundries out of this machined surface. In addition, only the two machined surface of the same connecting rod can completely engage.

The tightening torque for installing the fixing bolt of connecting rod bearing is 25±3Nm (then turn 90±5° clockwise).

11. Use the piston installation special tool to install the piston.



12. Tighten the fixing bolt of connecting rod bearing cap.

Tightening torque:

First time: 25±3Nm. Second time: turn 90±5 °.

13. Install the main bearing cap and then follow the order as shown in the figure to tighten the bolt.

Tightening torque:

First time: 45±5Nm.

Second time: turn 180±10°.

14. Tighten the fixing bolt of main bearing cap and cylinder block.

Torque: 20+3 Nm.

