S300

- # Engine repair manual (TNN4G15&16A) CKD

S300RM2A/6/1

Engine repair manual

TNN4G15&16A (CKD- S300)

Prepared by: _____

Reviewed by: _____

Approved by: _____

Ruizhan (Tongling) Technologies Co., Ltd.

Introduction

Engine maintenance and repair require strong professional. If an operator does not accept relevant maintenance technology training, property damage or even personal injury may occur during maintenance operation. Therefore, it is necessary to for an operator to receive appropriate training or study related technical information before engine maintenance and repair.

This manual mainly introduces a TNN4G1A engine maintenance and repair process and related technical parameter standards. In operation, it is suggested that vehicle relevant manuals, circuit diagrams, and other related data are used together, and operating instructions introduced in materials are strictly observed.

This manual is classified in accordance with engine part assemblies and systems (such as: generator, starter, lubrication system, etc.). This manual describes related information according to an engine outside-in disassembly order. (That is, an engine can be fully disassembled according to this manual.) It is recommended that this manual be read before maintenance and repair.

All content in this manual is the latest when being published. All used data is in accordance with the technical standards of TNN4G1A engines. Ruizhan (Tongling) Technologies Co., Ltd. reserves a right to modify engine technical characteristics and content in this manual. Technical personnel using this manual shall keep an eye on updated information at any time.

Contents

1. How Do We Use This Manual?

Scope

- This manual includes a maintenance operation procedure, which is divided into 5 basic operations.
  I Removing/Installation
  II Disassembly and Assembly
  III Reset
  IV Check
  V Adjustment
- Simple operations can be finished watching the engine appearance, such as removing/installing peripheral parts, cleaning parts, observing appearance, etc.

Maintenance procedure

1. Illustrations should be observed before most maintenance work is performed. Illustrations can help identify parts, and describe how parts are fixed together and how to check part appearance. Removing/installing procedures that require system display all have illustrations.
2. Symbols of vulnerable parts, tightening torques, lubricating oil, and sealant are described in the illustrations, and special tools or equipment during removing/installing are also marked and described.
3. Operation sequence and main part operation processes have corresponding numbers marked. Generally, this information is important for a diagnosis program, and therefore, an operation should pay attention to this reference information during part check.

Alerting signals

In this manual, you will see Warning, Caution, Attention, Instruction, and Upper and Lower Threshold.

Warning

- Personal injury may be caused if a warning prompt is ignored.

Caution

- An engine may be damaged if a caution prompt is ignored.

Attention

- An attention prompt provides overhead information of some program.

Instruction

- An instruction prompt provides allowable range during check and adjustment.

Upper and Lower Threshold

- Upper and lower thresholds are not allowed exceeded during check or adjustment.

2. Technical Specifications

2.1 Vehicle Technical Specifications

Engine model	TNN4G13A	TNN4G15A	TNN4G16A
Structural features	Inlinefour engine, i-vvt, DOHC16V, and MPI		
Number of cylinders	4		
Cylinder diameter x route (mm)	75×75.4	75×84.8	75×90
Displacement (L)	1.332	1.499	1.59
Compression ratio	10.5	10.31	10.5
Rated speed (r/min)	6000		
Total power (kw/rpm)	73/6000	83/6000	87/6000
Maximum torque (Nm/rpm)	127/4000	143/4000	151/4000
Lowest empty car stabilized speed (r/min)	750±50		
Lowest full-load fuel consumption (g/kw.h)	255		
Engine oil percentage depletion (%)	< 0.10		
Rotation direction of crankshaft (facing the flywheel end)	Anticlockwise		
Firing order	1-3-4-2		
Start-up mode	Electric starter		
Lubricating method	Pressure and spatter combination		
Dimensions (L×W×H) (mm)	565×585×605		
Net weight (kg)	110		
1. Rated power (1) discharge temperature (header pipe) ℃ (2) coolant temperature ℃ (3) oil temperature ℃ (header pipe) (4) maximum pressure of main oil gallery kPa	Manifold convergence point < 870 82-105 ≤ 110 ≤ 450 (oil temperature 95℃)		
2. Oil pressure when a vehicle drives at the lowest stabilized speed kPa (Oil temperature 75-95℃)	≤120		
3. Valve clearance (cold position) mm	Intake air: 0.2±0.05; Outlet air: 0.3±0.05		
4. Maximum oil loading level (including 0.3 L in the oil filter)	4.3 L		

2.2 Maintenance Technical Specifications

No.	Name	Standard Size	Fitting Property	Assembling Clearance
1	Main bearing hole of a cylinder body Crankshaft main journal Crankshaft bearing		Clearance	See section 7.1.6.
2	Crankshaft positioning gear of a cylinder body Crankshaft axial positioning gear	Cylinder body $18^{-0.050}_{-0.124}$	Clearance	+0.08-+0.255

No.	Name	Standard Size	Fitting Property	Assembling Clearance
	Crankshaft thrust plate	Crankshaft $24.55^{+0.045}_{0}$ Thrust plate $3.2^{+0.060}_{+0.052}$		
3	Positioning front edge of cylinder block main bearing hole Main bearing cap positioning front edge	Hole $92^{+0.054}_{0}$ Axle $92^{+0.036}_{+0.051}$	Transition	-0.086-+0.003
4	Location pinhole of cylinder block cover Location pinhole of cylinder cover	Hole $\Phi 6^{-0.008}_{-0.020}$ Axle $\Phi 6^{+0.012}_{+0.004}$	Interference	-0.032--0.012
5	Location pinhole of cylinder cover Location pin of cylinder cover	Hole $\Phi 6^{+0.052}_{+0.020}$ Axle $\Phi 6^{+0.012}_{+0.004}$	Clearance	+0.008-+0.028
6	Pin bush hole of cylinder block timing chain cover Pin bush of sprocket chamber cover	Hole $\Phi 9^{-0.009}_{-0.024}$ Axle $\Phi 9^{+0.015}_{+0.006}$	Interference	-0.039 - -0.015
7	Pin bush hole of timing chain cover Pin bush of sprocket chamber cover	Hole $\Phi 9^{+0.040}_{+0.025}$ Axle $\Phi 9^{+0.015}_{+0.006}$	Clearance	+0.01 - +0.034
8	Bracket location pinhole of cylinder body crankshaft rear seal Bracket location pinhole of crankshaft rear seal	Hole $\Phi 6^{-0.008}_{-0.020}$ Axle $\Phi 6^{+0.012}_{+0.004}$	Interference	-0.032 - -0.012
9	Bracket location pinhole of crankshaft rear seal Bracket location pinhole of crankshaft rear seal	Hole $\Phi 6^{+0.052}_{+0.020}$ Axle $\Phi 6^{+0.012}_{+0.004}$	Clearance	+0.008 - +0.028
10	Pin bush hole of transmission housing Pin bush of transmission housing	Hole $\Phi 11^{+0.027}_{0}$ Axle $\Phi 11^{0}_{-0.018}$	Clearance	0 - +0.045
11	Cylinder hole Piston skirt	Hole $\Phi 75^{+0.015}_{0}$ Axle $\Phi 75^{-0.01}_{-0.02}$	Clearance	+0.01 - +0.035
12	Cylinder body engine nozzle bore Oil nozzle	Hole $\Phi 4^{-0.045}_{-0.057}$ Axle $\Phi 4^{0}_{-0.02}$	Interference	-0.057 - -0.025
13	Crank bore Crankshaft connecting rod journal Connecting rod bearing shell	Hole $\Phi 43^{+0.014}_{0}$ Axle $\Phi 40^{0}_{-0.025}$ Bearing bush $1.5^{-0.004}_{-0.016}$	Clearance	See section 7.3.1.

No.	Name	Standard Size	Fitting Property	Assembling Clearance
14	Opening of crankshaft connecting rod journal Connecting rod big end width	$18^{+0.15}_{0}$ $18^{-0.10}_{-0.15}$	Clearance	+0.1 - +0.3
15	Piston pin boss hole Piston pin	Hole $\Phi 18^{+0.014}_{+0.010}$ Axle $\Phi 18^{+0.006}_{+0.001}$	Clearance	+0.005 - +0.013
16	Connecting rod big end hole Piston pin	Hole $\Phi 18^{-0.016}_{-0.026}$ Axle $\Phi 18^{+0.006}_{+0.001}$	Interference	-0.031 - -0.016
17	Piston 1st ring groove 1st ring gas ring	$1^{+0.04}_{+0.02}$ $1^{-0.01}_{-0.05}$	Clearance	+0.03 - +0.07
18	Piston 2nd ring groove 2nd ring gas ring	$1.2^{+0.05}_{+0.01}$ $1.2^{-0.01}_{-0.05}$	Clearance	+0.02 - +0.06
19	Piston oil ring groove Oil ring component	$2^{+0.05}_{+0.01}$ $2^{-0.05}_{-0.12}$	Clearance	+0.04 - +0.15
20	1st piston ring gap clearance (Measurement in measure gauge φ75+0.010)		Clearance	+0.15 - +0.3
21	2nd piston ring gap clearance (Measurement in measure gauge φ75+0.010)		Clearance	+0.3 - +0.5
22	Oil ring blade clearance (Measurement in measure gauge φ75+0.010)		Clearance	+0.1 - +0.6
23	Oil pump inner rotor bushing Crankshaft oil pump inner rotor bushing journal	Hole $\Phi 29.6^{+0.055}_{0}$ Axle $\Phi 29.6^{+0.06}_{+0.05}$	Interference	-0.0 - 6-0.017
24	Crankshaft timing sprocket Crankshaft timing sprocket journal	Hole $29.6^{+0.012}_{0}$ Axle $29.6^{+0.06}_{+0.05}$	Interference	-0.06 - -0.038
25	Crankshaft position signal gear ring hole Crankshaft position signal gear ring journal	Hole $\Phi 91^{+0.087}_{0}$ Axle $\Phi 91^{0}_{-0.035}$	Clearance	0 - +0.122
26	Location pinhole of crankshaft position signal gear ring on the crankshaft Location pinhole of crankshaft position signal	Hole $\Phi 6^{-0.050}_{-0.066}$ Axle $\Phi 6^{+0.012}_{+0.004}$	Interference	-0.067 - -0.034
27	Location pinhole of crankshaft position signal gear ring Location pinhole of crankshaft position signal	Hole φ6.3±0.1 Axle $\Phi 6^{+0.012}_{+0.004}$	Clearance	+0.188 - +0.396
28	Flying wheel positioning hole	Hole $\Phi 43^{+0.034}_{+0.009}$	Clearance	+0.009 - +0.059

No.	Name	Standard Size	Fitting Property	Assembling Clearance
	(automatic transmission) Crankshaft flywheel positioning journal	Axle $\Phi 43_{-0.025}^{0}$		
29	Flying wheel positioning hole (manual transmission) Crankshaft flywheel positioning journal	Hole $\Phi 43_{0}^{+0.025}$ Axle $\Phi 43_{-0.025}^{0}$	Clearance	0 - +0.05
30	Crankshaft damping pulley location pinhole Damping pulley location pinhole	Hole $\Phi 3_{-0.016}^{-0.006}$ Axle $\Phi 3_{+0.002}^{+0.008}$	Interference	-0.024 - -0.008
31	Damping pulley location pinhole Damping pulley location pinhole	Hole $\Phi 3_{+0.5}^{+0.4}$ Axle $\Phi 3_{+0.002}^{+0.008}$	Clearance	+0.292 - +0.398
32	Damping pulley location pinhole Crankshaft damping pulley location journal	Hole $\Phi 29.3_{0}^{+0.052}$ Axle $\Phi 29.3_{-0.033}^{0}$	Clearance	0 - +0.085
33	Gear ring inner diameter Flywheel ring gear journal (manual transmission)	Hole $\Phi 257.65_{-0.181}^{-0.149}$ Axle φ257.65±0.05	Interference	-0.231 - -0.099
34	Cylinder cover valve pipe hole Cylinder valve guide pipe	Hole $\Phi 10.5_{0}^{+0.018}$ Axle $\Phi 10.5_{+0.050}^{+0.068}$	Interference	-0.068 - -0.032
35	Valve guide inner diameter Intake valve stem diameter	Hole $\Phi 5_{0}^{+0.012}$ Axle $\Phi 5_{-0.038}^{-0.020}$	Clearance	+0.02 - +0.047
36	Valve guide inner diameter Exhaust valve stem diameter	Hole $\Phi 5_{0}^{+0.012}$ Axle $\Phi 5_{-0.046}^{-0.050}$	Clearance	+0.03 - +0.057
37	Cylinder cover intake valve seat hole Intake valve seat external diameter	Hole $\Phi 31.5_{0}^{+0.025}$ Axle $\Phi 31.5_{+0.076}^{+0.088}$	Interference	-0.088 - -0.05
38	Cylinder cover exhaust valve seat hole Exhaust valve seat external diameter	Hole $\Phi 28_{0}^{+0.021}$ Axle $\Phi 28_{+0.063}^{+0.076}$	Interference	-0.076 - -0.042
39	Cylinder cover valve tappet hole Valve tappet external diameter	Hole $\Phi 31_{0}^{+0.025}$ Axle $\Phi 31_{-0.036}^{-0.020}$	Clearance	+0.02 - +0.061
40	Cylinder cover camshaft 1 Cover location pinhole Camshaft cover 1 location pin	Hole $\Phi 6_{-0.020}^{-0.008}$ Axle $\Phi 6_{+0.004}^{+0.012}$	Interference	-0.032 - -0.012
41	Camshaft cover 1 location pinhole Camshaft cover 1 location pin	Hole $\Phi 6_{+0.020}^{+0.032}$ Axle $\Phi 6_{+0.004}^{+0.012}$	Clearance	+0.008 - +0.028

No.	Name	Standard Size	Fitting Property	Assembling Clearance
42	Cylinder cover camshaft hole Camshaft journal	Hole $\Phi 26^{+0.021}_{0}$ Axle $\Phi 26^{-0.016}_{-0.040}$	Clearance	+0.015 - +0.061
43	Intake camshaft thrust gear width Cylinder cover intake camshaft thrust gear width	$29^{+0.10}_{+0.05}$ $29^{-0.05}_{-0.10}$	Clearance	+0.1 - +0.2
44	Exhaust camshaft thrust gear width Cylinder cover exhaust camshaft thrust gear width	$20^{+0.10}_{+0.05}$ $20^{-0.05}_{-0.10}$	Clearance	+0.1 - +0.2
45	Cylinder cover ignition plug bushing hole Ignition plug bushing external diameter	Hole $\Phi 26^{0}_{-0.05}$ Axle $\Phi 26^{+0.10}_{+0.05}$	Interference	-0.15 - -0.05
46	Cylinder cover OCV oil control valve hole OCV oil control valve external diameter	Hole $\Phi 18^{+0.018}_{0}$ Axle $\Phi 18^{-0.006}_{-0.017}$	Clearance	+0.006 - +0.035
47	Exhaust camshaft location pinhole Exhaust camshaft location pinhole	Hole $\Phi 5^{-0.016}_{-0.027}$ Axle $\Phi 5^{0}_{-0.008}$	Interference	-0.027 - -0.007
48	VCP phase controller circumference locating slot Intake camshaft location pin	Hole $5^{+0.03}_{0}$ Axle $\Phi 5^{0}_{-0.008}$	Clearance	0 - +0.038
49	VCP phase controller rotor inner diameter Intake camshaft front end journal	Hole $\Phi 34^{+0.040}_{+0.009}$ Axle $\Phi 34^{0}_{-0.059}$	Clearance	+0.009 - +0.079
50	VCP phase controller sprocket inner diameter Intake camshaft front end journal	Hole $\Phi 34^{+0.026}_{+0.009}$ Axle $\Phi 34^{0}_{-0.059}$	Clearance	+0.009 - +0.064
51	Exhaust camshaft location pinhole Exhaust camshaft location pin	Hole $\Phi 5^{-0.016}_{-0.027}$ Axle $\Phi 5^{0}_{-0.008}$	Interference	-0.027 - -0.007
52	Exhaust camshaft timing sprocket circumference locating slot Exhaust camshaft location pin	Hole 5.15±0.05 Axle $\Phi 5^{0}_{-0.008}$	Clearance	+0.1 - +0.208
53	Exhaust camshaft timing sprocket location hole Exhaust camshaft front end journal	Hole $\Phi 34^{+0.043}_{+0.009}$ Axle $\Phi 34^{0}_{-0.059}$	Clearance	+0.009 - +0.087
54	Inner rotor hole of timing chain cover oil pump Inner rotor of oil pump	Hole $\Phi 72.9^{+0.15}_{+0.10}$ Axle $\Phi 72.9^{0}_{-0.056}$	Clearance	+0.1 - +0.165
55	Inner rotor hole depth of timing chain cover oil pump Inner rotor thickness of oil pump	Hole $9.2^{+0.05}_{+0.02}$ Axle $9.2^{0}_{-0.05}$	Clearance	+0.02 - +0.1

No.	Name	Standard Size	Fitting Property	Assembling Clearance
56	Piston top (surface) higher outlet after TNN4G13A assembling Cylinder body plane	2.6 - 2.94		
57	Piston top (surface) higher outlet after TNN4G15A assembling Cylinder body plane	-1.16 - -0.82		
58	Piston top (surface) higher outlet after TNN4G16A assembling Cylinder body plane	-1.125 - -0.815		

2.3 Tightening Torques

High strength bolt and nut:

No. 号	Part Number	Name	Specification	Quantity	Tightening Torques
1	1002023 - 04	Main bearing cap bolt (iron cylinder body)	M9x1.25	10	52Nm+60°
2	1002023 - 04	Main bearing cap bolt (aluminum cylinder body)	M9x1.25	10	35Nm+60°
3	1003012 - 04	Cylinder cover bolt	M9x1.25	10	24.5Nm+180°
4	1004022 - 04	Connecting rod bolt	M6x0.75	8	5Nm+15Nm+90°
5	1005014 - 04	Flywheel bolt	M11x1.25	6	100±5Nm
6	1025013 - 04	Damping pulley compression bolt	M14x1.5	1	130±5Nm
7	1006012 - 04	Intake camshaft sprocket bolt	M12x1.25	1	88±8Nm
8	1011011 - 04	Front mounting stud	M10x1.25	2	45±5Nm
9	1008015 - 04	Exhaust manifold clamp nut	M8	5	27-30Nm

Plain bolt:

No. 号	Part Number	Tightened Part	Specification	Quantity	Tightening Torques (N·m)
1	Q186083020	Oil filter base fastening bolt	M8×30	3	18.6 - 25.5
2	Q1860610Q	Fastening bolt of crankshaft rear seal bracket	M6×10	6	7.9 - 10.8
3	Q186064519	Water pump fastening bolt	M6×45	4	7.8 - 11.8
4	Q1860612Q	Fastening bolt of water pump pulley	M6×12	4	7.9 - 10.8
5	Q1860620Q	Oil collector fastening bolt	M6×20	2	7.9 - 10.8
6	Q1860820Q	Oil collector fastening bolt	M8×20	1	15 - 17
7	Q1860610Q	Oil sump fastening bolt	M6×10	14	7.9 - 10.8
8	Q1860612Q	Lower baffle fastening bolt	M6×12	4	7.9 - 10.8
9	Q186063519	Fastening bolts of camshaft cover 2nd, 3rd, 4th, and 5th gears	M6×35	16	10 - 12

10	Q186083020S	Fastening bolts of camshaft cover 1st gear	M8×30	3	19 - 21
11	Q1860612Q	OCV valve fastening bolt	M6×12	1	4.2 - 6.2
12	1006013 - 04	Fastening bolts of exhaust camshaft timing sprocket	M12×1.25×30	1	80 - 96
13	Q1860612Q	Fastening bolts of timing chain guide rail	M6×12	2	8 - 12
14	1021014 - 04	Tensioning arm fastening bolt	M8	1	19 - 28
15	Q186062518	Tensioner fastening bolt	M6×25	2	8 - 12
16	Q186062518	Timing chain cover fastening bolt	M6×25	9	8 - 12
17	Q186063018	Timing chain cover fastening bolt	M6×30	2	8 - 12
18	Q186064519S	Timing chain cover fastening bolt	M6×45-S	1	8 - 12
19	1011014 - 04	Timing chain cover fastening bolt	M10×1.25×50	1	40 - 50
20	1011015 - 04	Timing chain cover fastening bolt	M10×1.25×50	1	40 - 50
21	1011016 - 04	Timing chain cover fastening bolt	M10×1.25×90	2	40 - 50
22	Q1860612Q	Oil gage tube fastening bolt	M6×12	1	7.9 - 10.8
23	3707020 - 04	Ignition plug	M14×1.25	4	20 - 30
24	Q1860616Q	Fastening bolt of crankshaft position sensor	M6×16	1	7.8 - 9
25	1003014 - 04	Cylinder cover fastening bolt	M6	10	8 - 10
26	Q1860616Q	Fastening bolt of camshaft position sensor	M6×16	1	7.9 - 10.8
27	Q186083020	Fastening bolt of knock sensor	M8×30	1	18.4 - 21.6
28	1017020 - 04	Oil filter	M20×1.5	1	13.5 - 13.9
29	Q1860620Q	Fastening bolt of temperature controller cover	M6×20	2	7.8 - 10.8
30	Q1860612Q	Fastening bolt of return pipe welding assembly	M6×12	1	7.8 - 10.8
31	Q1860620Q	Fastening bolt of return pipe welding assembly	M6×20	2	7.8 - 10.8
32	3611050 - 04	Cooling liquid temperature sensor	R 3/8	1	15.7 - 23.5
33	Q186084024	Intake manifold clamp nut	M8×40	5	17 - 19.8
34	Q1860816Q	Intake manifold bracket fastening bolt	M8×16	2	17 - 19.8
35	Q1860820Q	Intake manifold bracket fastening bolt	M8×20	1	15.7 - 18
36	Q186065019	Fastening bolt of throttle valve assembly	M6×50	4	6.9 - 8
37	Q1860618Q	Ignition coil fastening bolt	M6×18	4	7.9 - 10.8
38	Q1860820Q	Exhaust manifold bracket fastening bolt	M8×20	2	15.7 - 22.6
39	1008017 - 04	Exhaust manifold bracket fastening bolt	M10×1.25×20	1	31.4 - 46.1
40	Q1200820	Stud	GM8-M8×20	5	7.9 - 11.8
41	Q1860820Q	Fastening bolt of rear hanging hook assembly	M8×20	2	17 - 19.8
42	Q142083519	Fastening bolt of fuel rail assembly	M8×35	2	18.6 - 25.5

43	3610016 - 04	T-map fastening bolt	REMFORM M6×20	2	6.9 - 8
44	3827020 - 04	Oil pressure switch	R1×1×8	1	28 - 29.4
45	1008036 - 04	Exhaust pipe heat screen part	M6×16	6	5 - 7
46	Q142103522	Engine regulation bracket fastening bolt	M10×1.25×35	1	37.3 - 52
47	Q146109022	Fastening bolt of generator rotating center	M10×1.25×90	1	37.3 - 52
48	3700013 - 04	Square nut	M10×1.25	1	37.3 - 52
49	Q186084024	Generator regulation block	M8×40	1	18.6 - 25.5
50	1009011 - 04	Drain plug	M14×1.5×13	1	29.4 - 41.2
51	1017014 - 04	VVT oil strainer bolt	M14×1.5	1	38 - 42
52	Q1860612Q	Carbon tank solenoid valve bracket	M6×12	1	8 - 12

2.4 Vulnerable Part List

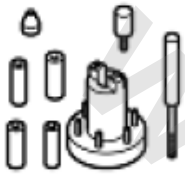
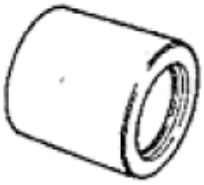
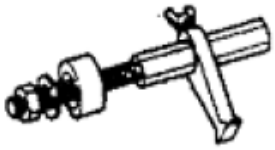
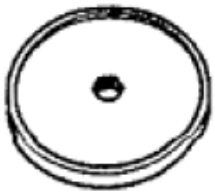
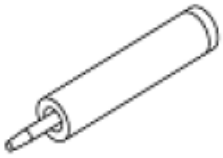
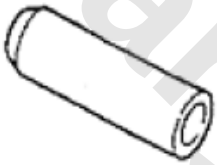
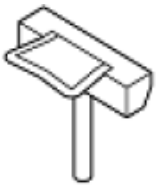
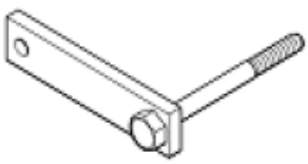
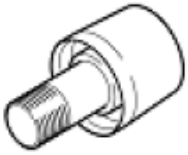
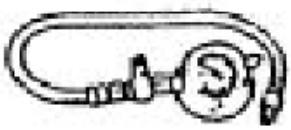
TNN4G1 vulnerable part list

Part Number	Name
1002011 - 04	Crankshaft upper bearing
1002012 - 04	Crankshaft lower bearing
1002013 - 04	Crankshaft thrust plate
1002030 - 04	Parts of crankshaft rear seal bracket
1003015 - 04	Cylinder cover gasket
1007011 - 04	Intake valve
1007012 - 04	Exhaust valve
1007013 - 04	Valve spring
1007014 - 04	Valve key
1007015 - 04	Valve spring upper seat
1007016 - 04	Valve spring lower seat
1007017 - 04	Valve lifter
1007020 - 04	Valve oil seal
1004011 - 04	1st gas ring
1004012 - 04	2nd gas ring
1004014-04B1	Connecting rod bearing shell
1014020 - 04	PCV valve assembly
1004030 - 04	Oil ring component
1017020 - 04	Oil filter assembly
1601030 - -03	Clutch driven disk
3611020 - 04	Intake pressure temperature sensor
3611030 - 04	Crankshaft position sensor
3611040 - 04	Camshaft position sensor
3611050 - 04	Cooling liquid temperature sensor
3611060 - 04	Knock sensor

3612020-03/3612020-04	Fuel rail assembly
3705020 - 04	Ignition coil
3707020 - 04	Ignition plug
3827020 - 04	Oil pressure sensor assembly
TNN4G12-3601080	Carbon tank solenoid valve
GB/T 13871-2007	Oil seal

3. Special Tool

(These tools are not provided by the company.)

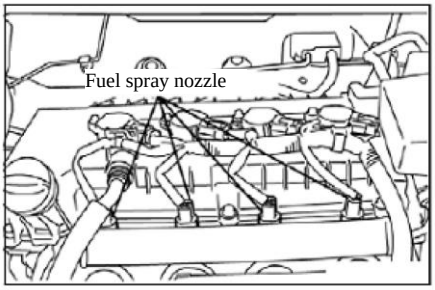
Tappet retaining appliance component 	Crankshaft oil seal installer 	Valve spring ejector 
Piston pin assembling tool kit 	Dust cover installer 	Gear ring arresting device 
Oil seal installer 	Oil filter sleeve 	Valve guide pipe ejecter/installer 
Valve oil seal and guide pipe installer component 	Guider 	Bushing installation device 
Oil seal installer 	Oil sump ejecter 	Crankshaft adapter 
Fly wheel brake 	Crankshaft front oil seal 	Oil seal installer 
Dust cover installer 	Belt pressure gauge 	Oil pressure gage 

4. Vehicle Check and Maintenance

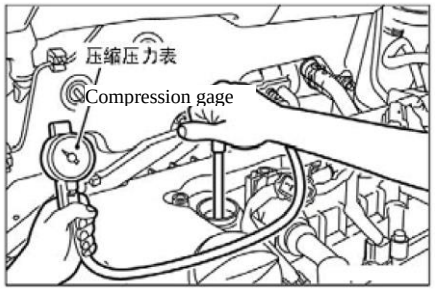
4.1 Compression Pressure Examination

Warning

- The oil temperature is very high for a heat engine. Be careful not to be burned when an engine is removed or installed.



4.1.1 Set a vehicle to a normal pre-check state: heat engine to TF normal operating temperature, motor turning off for 10-minute cooling.
4.1.2 Remove the fuel pump relay.
4.1.3 Disconnect the harness connector of the ignition coil.
4.1.4 Remove the ignition coil and spark plug (see the ignition and control system related sections) of cylinder 1.



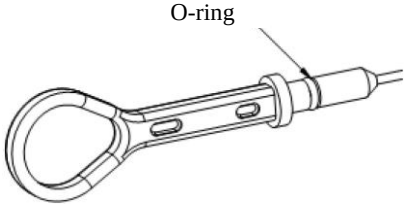
4.1.5 Connect a pressure gage in the spark plug hole of cylinder 1.
4.1.6 Step on the accelerator pedal to the end and start the engine.
4.1.7 Record the maximum value on the barometer.
4.1.8 Check compression pressure of all cylinders and check whether cylinder pressure difference is lower than the minimum limit according to above methods.
Limit: Maximum value 98 (kPa)

Item	Standard Value	Minimum Limit
Compression pressure kPa{kgf/cm²}[rpm]	1170 {12.0} [300]	98 {10.0} [300]

★Note: If the repulsive force of the umbrella cylinder or multi cylinders is excessively low, the difference between cylinders will exceed the specified limit value. Then drop a few drops of engine oil and repeat steps 5-7 to reexamine it.
If compression pressure increases, a fault is caused by living ink, living base ring, or cylinder internal surface wear, and complete repair is required.
If the pressure of cylinder 1 is low, the cylinder gasket may be damaged or the cylinder cover deforms. Complete repair is required.
If compression pressure is still low, the valve seat is burned or bad and the valve seal surface is not closely contacted. Complete repair is required.

4.2 Engine Oil Check

4.2.1 Park a vehicle on a level ground.
4.2.2 Heat the engine to a normal working temperature and park the vehicle.
4.2.3 Wait for 5 minutes.
4.2.4 Pull the oil level gauge out to observe oil surface height and oil



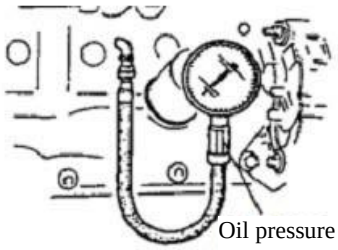
conditions and check whether it is between the upper limit mark and the lower limit mark.
4.2.5 Add or replace oil as required.
4.2.6 Confirm the oil gage. See the figure on the right for O ring installation.
4.2.7 Insert the oil gage back.

4.3. Oil Pressure Check

Warning

- Waste oil is liable to cause cancer. Cleanskin with soap and clean water immediately after work is finished.

4.3.1 Remove the oil pressure switch.
4.3.2 Install special tools in installation holes of an oil pressure switch.
4.3.3 Heat the engine to a normal working temperature.
4.3.4 Set the engine to a certain rotate speed and pay attention to reading to an oil pressure gauge.
4.3.5 Turn off the engine and cool the engine.
4.3.6 Remove the special tool.

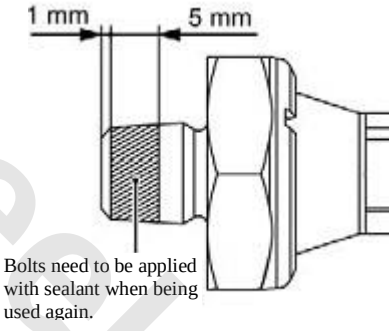

Oil pressure gage

- If pressure is not within the specified range, check the reason, repair the engine, and replace oil as required.

Attention

- Pressure for oil in different viscosity and temperature may be different. Oil pressure: 400-588kPa{4.1-6.0kgf/cm }[2500rpm]

4.3.7 As shown in the figure on the right, apply the threaded sealant (A6F011) evenly to the oil pressure switch threads.
4.3.8 Install the oil pressure switch. Tightening torque: 14.7N·m{1.5kgf·m}
4.3.9 Start the engine to check whether the oil is leaking.



Bolts need to be applied with sealant when being used again.

4.4 Engine Oil Replacement

4.4.1 Remove oil filler cap and oil drain plug.
4.4.2 Put oil into a suitable container.
4.4.3 Replace with a new washer and install oil drain plug. Tightening torque: 30～41N·m{3.1～4.2kgf·m }
4.4.4 Refill oil with specified model and dose in an engine.
4.4.5 Check oil gage scale.
4.4.6 Reinstall oil filler cap.
4.4.7 Start the engine to check whether the oil is leaking.
4.4.8 Check engine oil position and add oil as required (see engine oil check).

Attention

- **In some cases, actual amount of oil injected according to the oil position and scale may be different from the oil specified amount.**

Oil capacity (L)

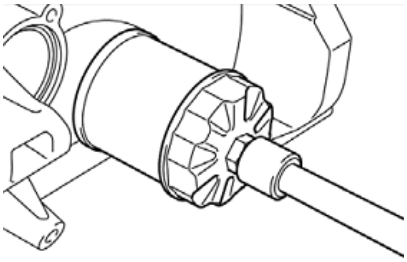
Item	Capacity
Oil replacement	3.6
Oil and oil filter replacement	3.8

- **Engine oil level: API engine oil level is above SL.**

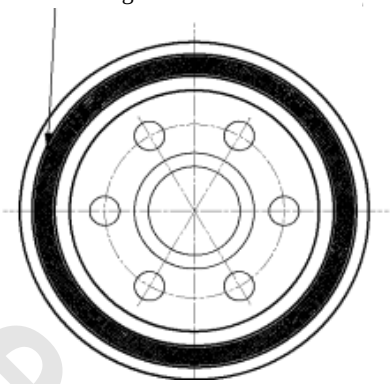
Oil viscosity selection standards	Oil viscosity level
Higher than -25℃	SAE 10W-30
-30℃～-37℃	SAE

4.5 Oil Filter Replacement

4.5.1 Remove the oil filter with a special tool.
4.5.2 Clean the surface of the new oil filter with a clean cloth.
4.5.3 Apply clean oil on the periphery of O ring of the new oil filter.
4.5.4 Install the oil filter with a special tool.
Tightening torque: 13.0～15.0N·m{1.32～1.52kgf·m}
4.5.5 Start the engine to check whether the oil is leaking. Check whether the oil surface height needs to be increased (see engine oil check).



Apply clean oil on the periphery of O ring.



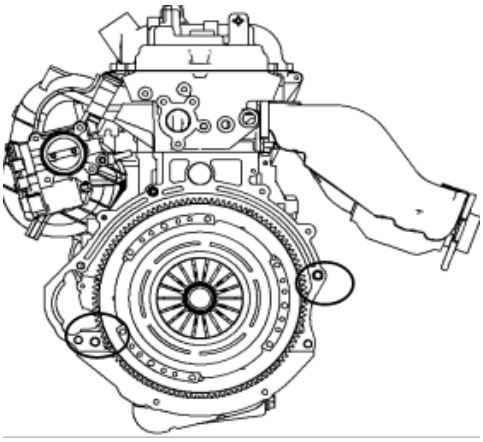
4.6. Others

Other check and maintenance, such as generator check, starter check, etc., may also be carried out on the vehicle. Refer to this manual and corresponding vehicle maintenance manual.

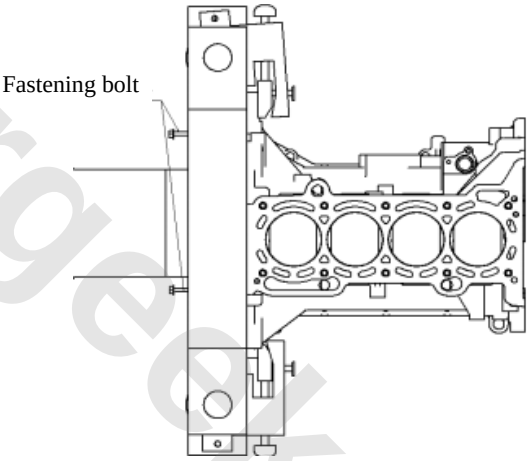
5. Usage of Engine Maintenance Platform

5.1 Engine Maintenance Platform

5.1.1 The engine is hoisted, pin holes on the cylinder body are aligned with the installation location pin on the maintenance platform, and the engine is installed (as shown in the figure).



5.1.2 Install and lock the work fixture according to positions as shown in the figure in the right.



5.1.3 Adjust fastening bolts to an appropriate position to prevent engine mounting from loosening

5.1.4 Put engine oil in a specified container.

5.1.5 Replace with a new oil drain plug gasket, and tighten the drain plug. Tightening torque: 30 - 41N·m{3.1～4.2kgf·m}

5.2 Engine Lower Maintenance Platform

Remove the engine from the maintenance platform in the opposite direction to the engine upper maintenance platform.

Attention

- **The self-locking braking system of engine maintenance platform may suddenly fail in unbalanced state. For example, the engine maintenance platform may be balanced due to sudden and rapid actions when the platform is lifting on or removed from the bracket, resulting in danger. Therefore, during operation, ensure the engine and the maintenance platform is balanced; when the engine is being turned over, tightly hold the rotation handle of the maintenance platform.**

6. Generator and Starter

6.1 Generator Removing and Installation

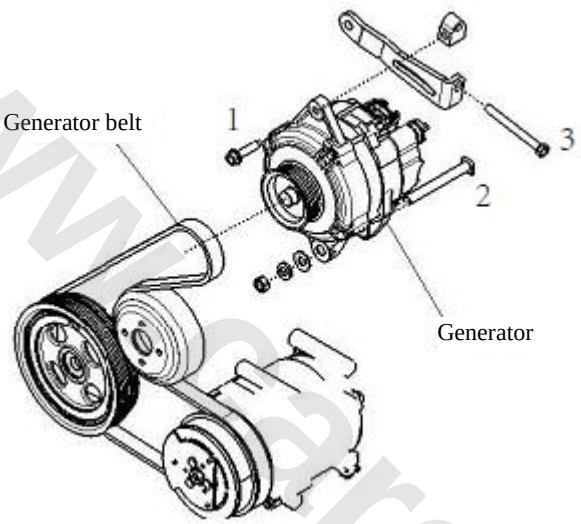
Warning

- **When a generator is removed from a vehicle, battery cables should be removed. Otherwise, generator binding post B will contact the vehicle body, spark will occur, injury to personnel will be caused, and electrical components will be damaged.**

6.1.1 Three bolts are loosened to remove the generator according to the sequence indicated by numbers in the figure.

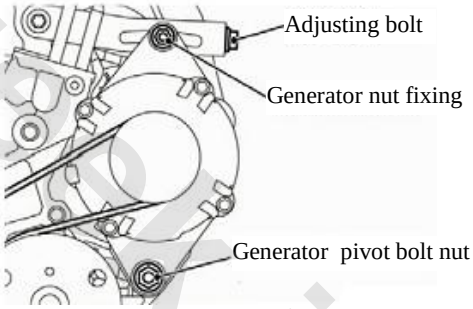
6.1.2 Install it in a reverse order to removing

6.1.3 Check belt deflection/tensioning force (see generator belt check).



6.2 Generator Belt Check Instructions

When necessary, check generator belt deflection and tension force. 见



6.3 Tensioning Force Adjustment Instructions of Generator and Air-conditioned Belt

6.3.1 Loose a nut on a generator pivot bolt.

6.3.2 Loose generator fixing bolt.

Use an adjustment bolt to adjust belt tensioning force and belt deviation to a specified value.

6.3.3 Tighten a nut on a generator pivot bolt. Tightening torque: 37.3 - 52N·m 6.3.4. Tighten generator fixed screw cap. Tightening torque: 37.3 - 52 N·m

6.3.5 Tighten the adjusting bolt. Tightening torque: 18.6 - 25.5N·m

Attention

Adjust a generator belt according to standards of a new part, if the belt is new or operated for no more than 5 minutes.

Adjust a generator belt according to standards of an old part, if the belt is operated for more than 5 minutes.

If a belt is not involved in a standard value range, adjust it starting from step 1.

6.4 Generator Check Instructions

6.4.1 Confirm that the battery is well charged.

6.4.2 Confirm that belt deflection/tensioning force is within the specified range (see content of check on the generator and the belt).

6.4.3 Turn the ignition switch to "ON" and the charging warning light is on.
6.4.4 Confirm that the charging warning light is off after the engine runs.
If it is not so, refer to corresponding vehicle fault diagnosis.

6.5 Starter Removing and Installation

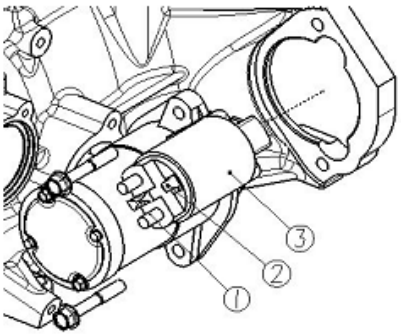
Warning

During engine removing/installation, if the battery positive cable is not loosened, starter binding post B will contact the vehicle body, spark will occur, injury to personnel will be caused, and electrical components will be damaged. Therefore, you should remove battery positive cables before operation.

6.5.1 Remove battery negative cables.

6.5.2 Remove it according to the sequence shown in the figure.

6.5.3 Install it in a reverse order to removing



1	Binding post cable B
2	Binding post cable S
3	Starter

6.6 Starter Check Instructions

6.6.1 Check on Devices Installed on Vehicle

6.6.1.1 Confirm that the battery is well charged.

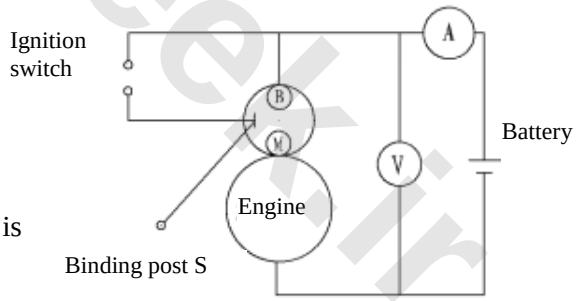
6.6.1.2 Start the starter to confirm that the starter runs smoothly and has no noise.

- **If incorrect, turn the ignition switch to "START" and measure the voltage of binding posts S and B.**
  - If the voltage is not within the specified range, check harness and ignition switch.
  - If the voltage is within the specified range, remove starter and check the electromagnetic switch and starter.

6.6.2 No Load Test

6.6.2.1 Confirm that the battery is well charged.

6.6.2.2 Connect the starter, battery, voltmeter, and ammeter according to the right figure.



6.6.2.3 Drive the starter to work and confirm that the operation is smooth.

6.6.2.4 Measure the voltage and current when the starter works.

- **If incorrect, repair or replace the starter.**
  Standard voltage: 11 (V)
  Standard current ＜95 (A)

7. Ignition and Control system

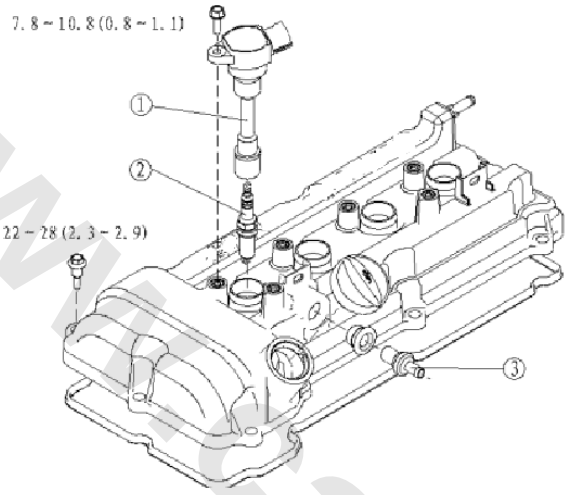
7.1 Removing/Installation of Ignition Coils, PCV Valves, and Spark Plugs

Caution

- **When the ignition coil and spark plug are removed, it is easy to tear the sheath of the connecting rod. Therefore, only when it is necessary, will they be removed. Therefore, we should be careful to avoid tear or damage during removing.**

7.1.1 Remove it according to the sequence shown in the figure.

7.1.2 Install it in a reverse order to removing



1	Ignition coil
2	Ignition plug (see content of ignition plug removing/installation)
3	Positive crankcase ventilation (PCV valve)

7.2 Ignition Plug Removing/Installation

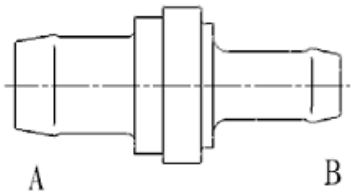
Caution

- **The spark plug must be installed carefully, and the strong impact will cause damages to the spark plug.**

7.3 PCV Valve Removing and Check

7.3.1 Remove the PCV valve.

7.3.2 Confirm that the PCV valve ventilation is normal, as shown in the figure. If it is abnormal, replace the PCV valve.



Air ventilation condition table

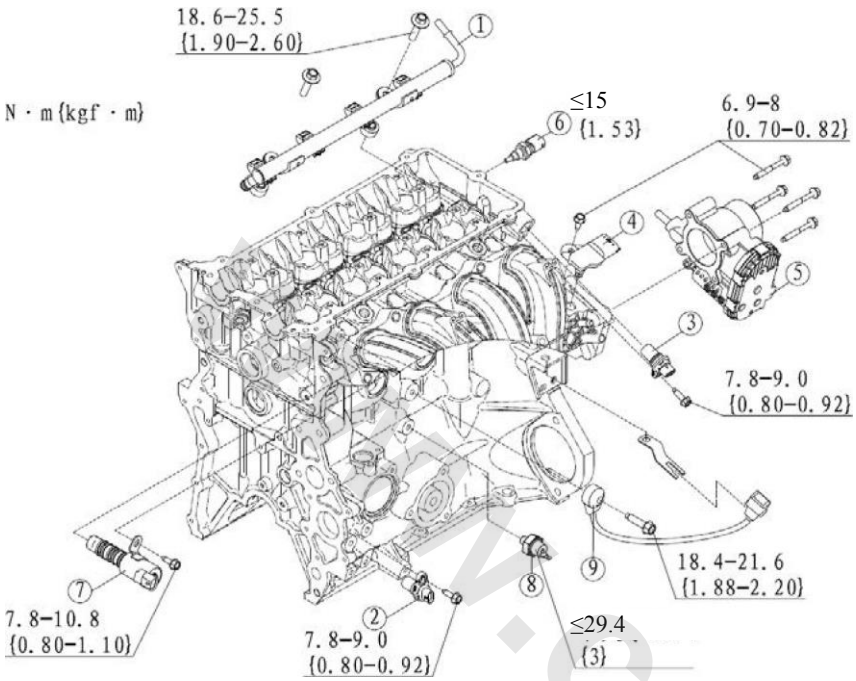
Test Condition	Test Result
Blowing to A	Air flowing to interface B

Blowing to B	No air flowing to interface A

7.4 Control System Part Removing/Installation

7.4.1 Remove it according to the sequence shown in the figure.

7.4.2 Install it in a reverse order to removing



1	Fuel rail
2	Crankshaft position sensor (see content of check on the
3	Camshaft position sensor
4	Pressure temperature sensor
5	Throttle body
6	Water temperature sensor (see removing/installation
7	Oil control valve
8	Oil pressure sensor
9	Knock sensor

★Note 1: This section lists support of control system parts of the engine. See corresponding vehicle parts for related fault diagnosis and check.

7.5 Check Instructions of a Crankshaft Position Sensor

Interval check

Attention

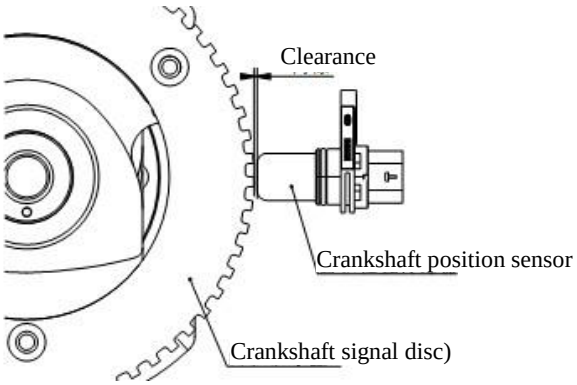
The following check is performed only when being necessary.

7.5.1 Confirm that the crankshaft speed sensor is correctly installed.

7.5.2 Measure clearance between signal wheel rising platform and crankshaft sensor using a filler gauge.

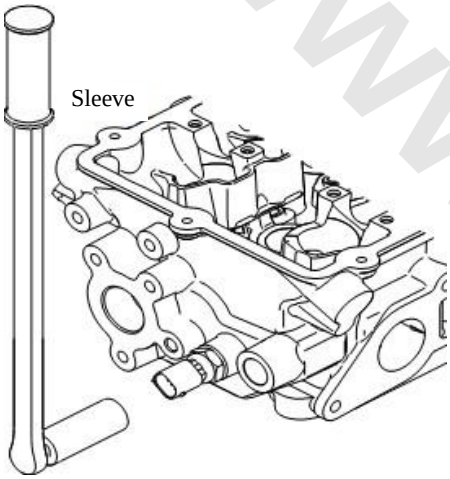
Attention

- **If clearance is not correct, adjust the crankshaft sensor or check whether distortion or openness occurs in signal wheel embossment (if there is, replace crankshaft signal disc).**
  Clearance standard value: 0.5 - 1.5 mm



7.6 Removing/Installation Instructions of a Water Temperature Sensor

Remove a water temperature sensor with a sleeve.

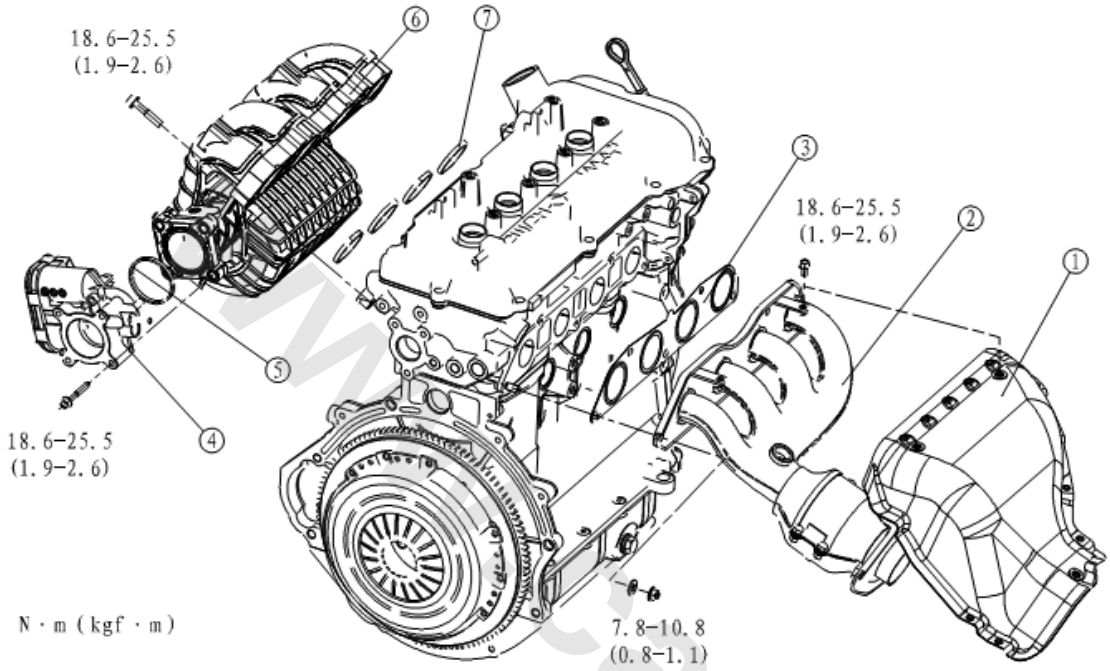


8. Intake and Exhaust Systems

8.1. Removing/Installation of Air Intake and Exhaust Systems

8.1.1 Remove it according to the sequence shown in the figure.

8.1.2 Install it in a reverse order to removing



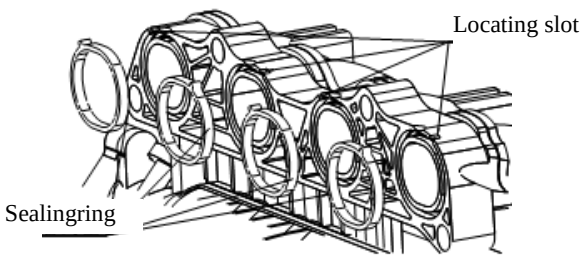
1	Upper heat insulation cover of an exhaust manifold
2	Exhaustmanifold
3	Exhaustmanifold sealing gasket
4	Throttle body
5	Throttle body seal ring (see installation instructions)
6	Intake manifold
7	Intake manifold seal ring (see installation instructions)

8.2 Seal Ring Installation Instructions of an Intake Manifold

During installation, the seal ring should be put into the intake manifold properly in grooves, and seal ring error prevention marks should be clipped into locating grooves of the intake manifold.

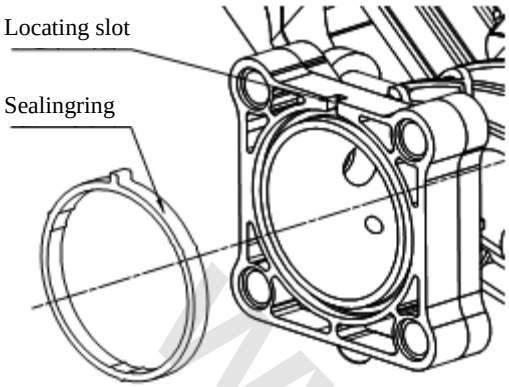
Caution

- **Before being installed, the seal ring should be check for damages. Replace the seal ring if any damage occurs.**



8.3 Installation Instructions of a Throttle Body Seal Ring

During installation, the seal ring should be put into the intake manifold properly in grooves, and seal ring error prevention marks should be clipped into locating grooves of the intake manifold.

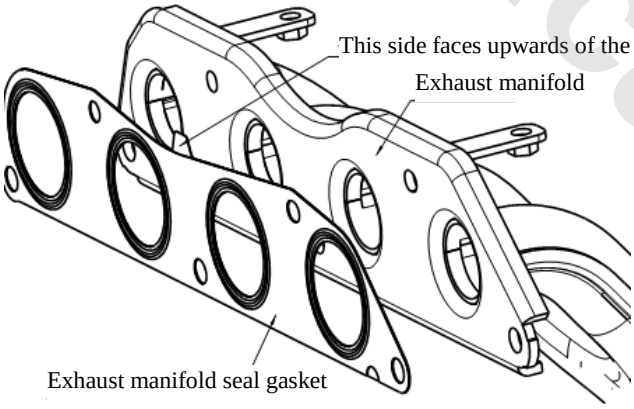


Attention

- **Before being installed, the seal ring should be check for damages. Replace the seal ring if any damage occurs.**

8.4 Installation Instructions of an Exhaust Manifold Seal Ring

The seal gasket faces to the exhaust manifold with the side with marks during installation.



9. CVVT

9.1. Removing/Installation of CVVT

9.1.1 Remove the generator belt (see content of generator).

9.1.2 Remove the crankshaft position sensor (see content of ignition and control system).

9.1.3 Remove the ignition coil (see content of the ignition coil).

9.1.4 Remove the head cover (see content of the head cover).

9.1.5 Remove the oil sump.

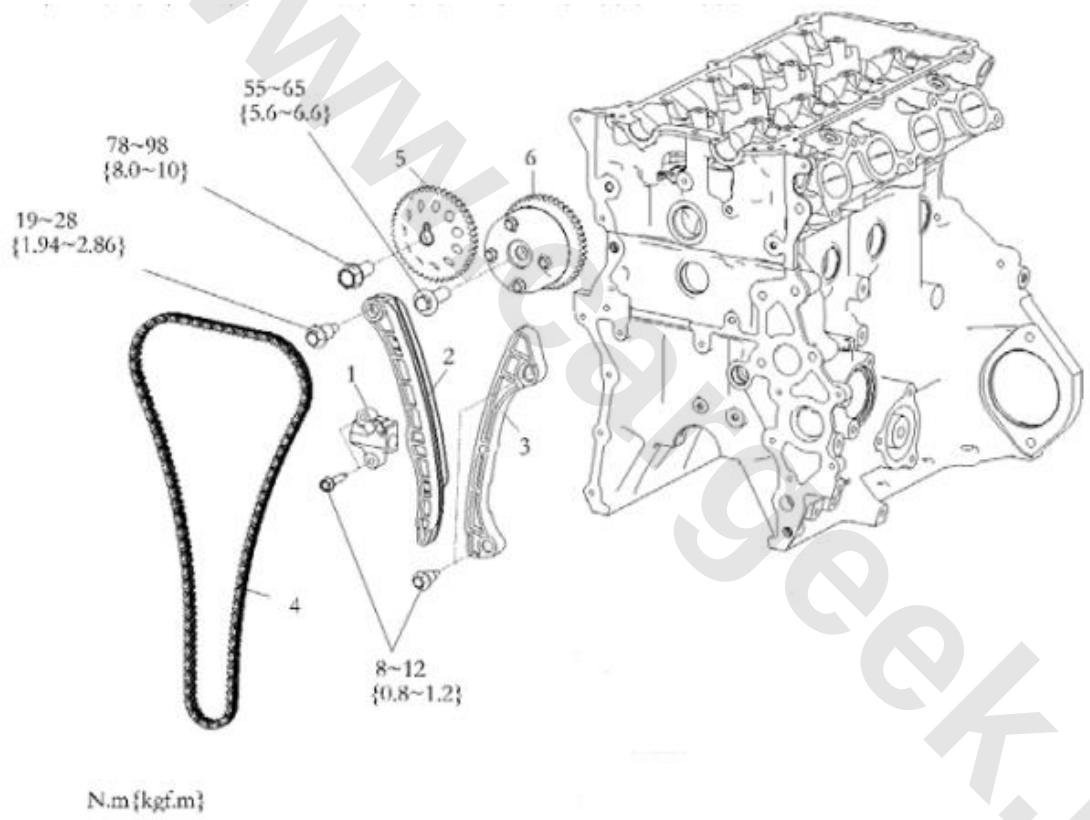
9.1.6 Remove the oil pump and the timing chain box assembly (see content of the oil pump and the timing chain box).

9.1.7 Remove it according to the sequence shown in the figure.

9.1.8 Install it in a reverse order to removing

9.1.9 Adjust the deflection/tensioning force of the generator belt (see content of the generator).

9.1.10 Check crankshaft position sensor clearance (see content of the ignition and control system).



1	Timing chain tensioner assembly
2	Tensioner arm assembly
3	Timing chain guide rail assembly
4	Timing chain
5	Camshaft sprocket
6	Intake VVT assembly

9.2 Removing Instructions of the Timing Chain Tensioner Assembly

9.2.1 Remove the assembly according to the sequence shown in the above figure.

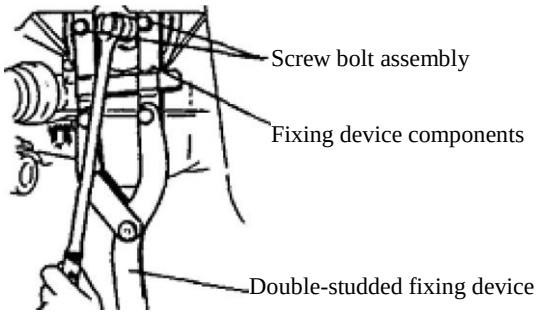
9.2.2 Install it in a reverse order to removing

Attention

Loosen the timing chain tensioner bolt and slowly take down the timing chain tensioner (preventing the plunger popping out suddenly).

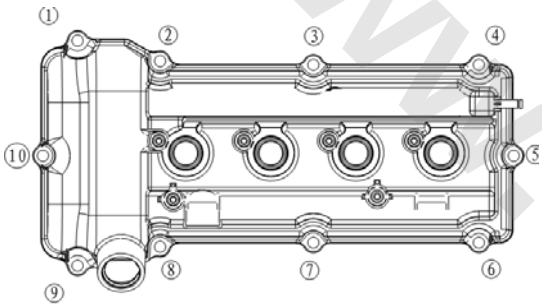
9.3 Removing Instructions of the Crankshaft Pulley

Remove the crankshaft using special tools.



9.4 Head Cover Removing Instructions

Loosen the bolt according to the sequence shown in the figure.



9.5 Timing Chain Removing Instructions

Attention

- **The key groove of the timing chain face upwards.**
- **Align air distribution check marks with air intake VVT and the timing sprocket on the exhaust side.**

9.5.1 Remove the timing chain tensioner assembly (see content of timing chain tensioner assembly).

9.5.2 Remove the tensioner arm assembly.

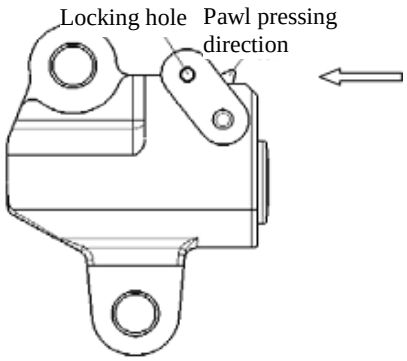
9.5.3 Remove the timing chain guide rail assembly.

9.5.4 Remove the timing chain.

9.6 Installation Instructions of the Timing Chain Tensioner Assembly

9.6.1 Press the pawl back using a vise (direction as shown in the figure), insert a hard wire into the lock hole, and lock the timing chain tensioner assembly.

9.6.2 Install the timing chain tensioner assembly on the cylinder, and tighten the bolt.

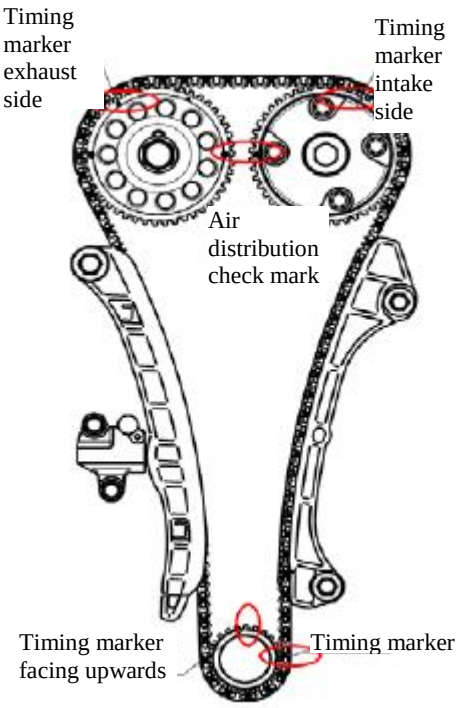


9.7 Installation Instructions of Tensioner Arm Assembly

After being installed, the tensioner arm cannot be excessively tightened, and swing the tensioner arm assembly to check whether it can fall freely.

9.8 Timing Chain Installation Instructions

9.8.1 Rotate the intake and exhaust camshafts to make the intake VVT and 2 timing sprockets on the exhaust side to mark at a specified angle.



9.8.2 Install the timing chain guide rail assembly.

9.8.3 Install the timing chain.

Attention

- **Timing marks on the intake VVT (intake side timing sprocket) and the timing sprocket on the exhaust side are aligned.**

9.8.4 Install the tensioner arm assembly (see the installation instructions of the tensioner arm assembly).

Attention

- **Ensure that the timing chain is located in the slot of the guide rail assembly and of the tensioner arm assembly.**

Pull out the interlock pin of the timing chain tensioner, and then the push rod pops out and pushes the tensioner arm to press the timing chain.

Attention

- **Confirm that the timing chain is in groove between the tensioner arm assembly and the timing chain guide rail.**

9.8.6 Confirm that all timing marks (4) and valve timing mechanism check mark (1) are fully aligned.

Attention

- **If they are not aligned, remove the timing chain and perform the operation from step 1.**

9.8.7 Clockwise rotate the crankshaft for two circles and then rotate the crankshaft to align the intake VVT assembly (intake timing sprocket) with two air distribution check marks on the exhaust side camshaft chain.

Attention

- **If they are not aligned, perform the operation from step 1.**

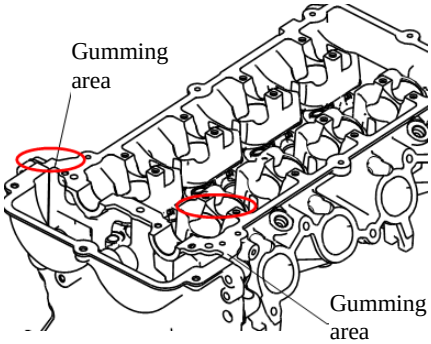
9.9 Head Cover Installation Instructions

9.9.1 Confirm that there is no oil, water and other foreign material in the groove of the cylinder cover.

9.9.2 Confirmed that the seal gasket of the cylinder cover has been fully fitted into the groove of the cylinder cover.

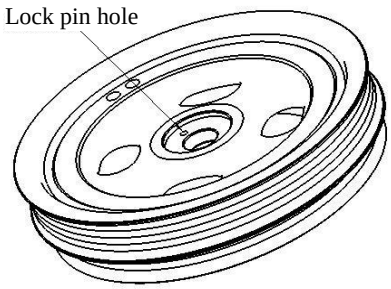
9.9.3 Apply the sealant at the connection between the cylinder cover and the oil pump, and between the cover and the timing chain box assembly.

9.9.4 Cylinder cover bolts are installed according to an order reverse to disassembly (see content of disassembly of the cylinder cover), and cylinder cover bolts are tightened in steps.



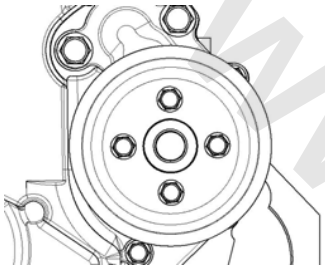
9.10 Installation Instructions of the Crankshaft Pulley

Install the crankshaft using special tools.



9.11 Installation Instructions of the Water Pump Pulley

Install the water pump pulley and tighten the bolt.



10. Lubrication System

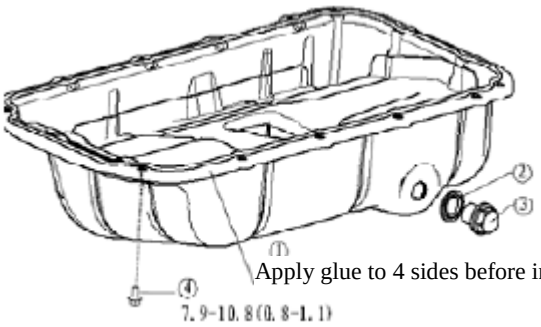
10.1 Oil Sump Installation/Removing

10.1.1 Release oil (see content of check on upper vehicle and replacement of engine oil).

10.1.2 Remove the oil sump according to the order shown in the following figure.

10.1.3 Install it in a reverse order to removing.

1	Oil sump (see removing/installation instructions)
2	Combined washer
3	Oil drainage washer
4	Bolt



10.2 Oil Sump Installation Instructions

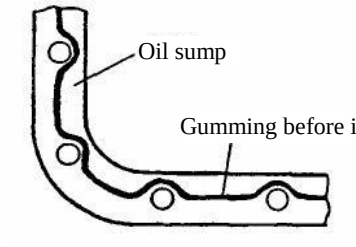
Caution

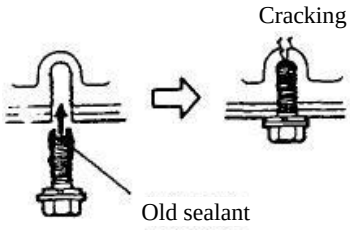
- **If a bolt is used repeatedly, sealant on an old thread must be removed. A screw with old sealant may cause a screw hole to be damaged.**

10.2.1 Continuous sealant is added to the inner side of the bolt hole of the oil pan, and the end part is overlapped.

Gum diameter: Φ2.0 - Φ3.0mm

10.2.2 Oil Sump Installation





10.3 Removing/Installation of Oil Pump and Timing Chain Box Assembly

10.3.1 Remove the oil gage and the conduit.

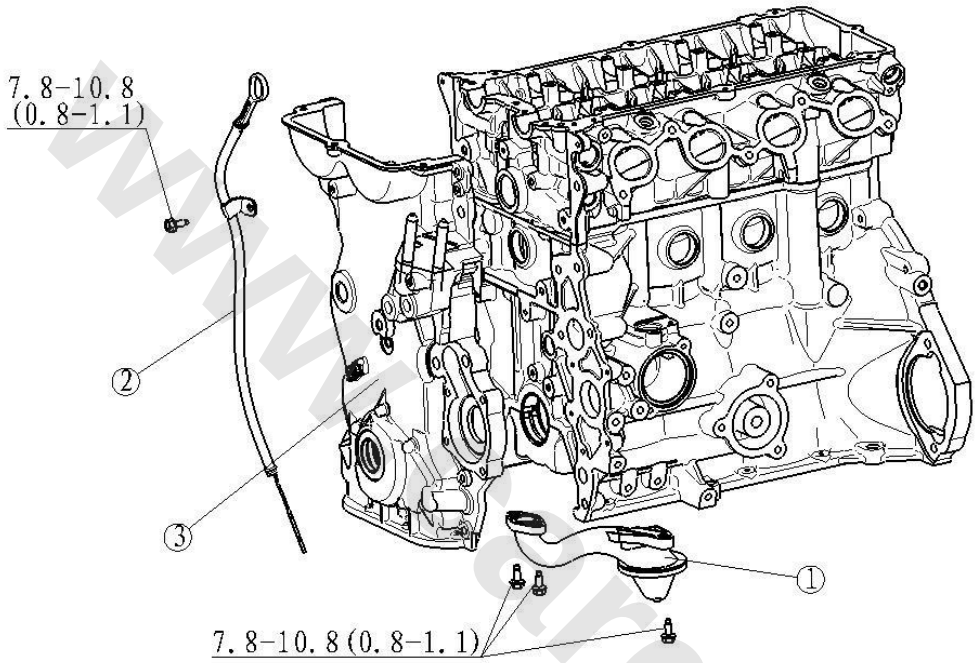
10.3.2 Remove the crankshaft pulley (see content of the crankshaft pulley)

10.3.3 Remove the cylinder cover (see content of cylinder cover instructions).

10.3.4 Remove the oil sump (see content of oil sump removing/installation).

10.3.5 Remove the water pump (see content of water pump removing/installation).

10.3.6 Install it in a reverse order to removing.



1	Oil filter (see installation instructions).
2	Oil gage conduit
3	Oil pump and timing chain box assembly (see removing/installation instructions)

10.4 Removing Instructions of Oil Pump Seal

When necessary, a screwdriver is wrapped with a clean cloth and oil seal is removed gently. The removed oil seal should be replaced.

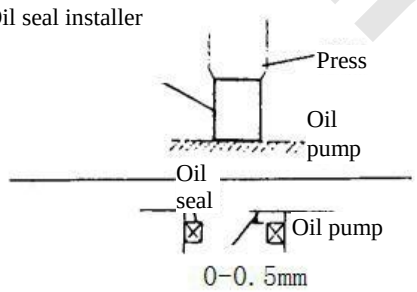
10.5 Installation Instructions of Oil Pump and Timing Chain Box Assembly

10.5.1 Apply clean oil to the periphery of the oil seal.

10.5.2 Manually install the oil seal.

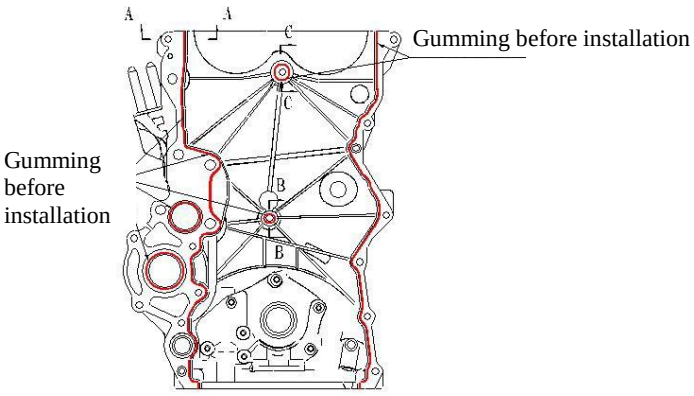
10.5.3 Press the oil seal evenly using professional tools.

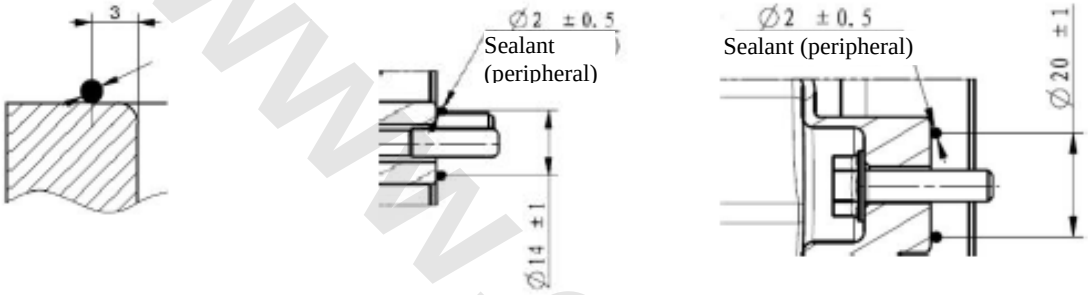
Pressed depth: 0-0.5 mm



10.5.4 Apply the sealant evenly and continuously to the edge of the engine oil pump and the timing chain box, as shown in the figure.

Glue diameter: Φ2±0.5mm



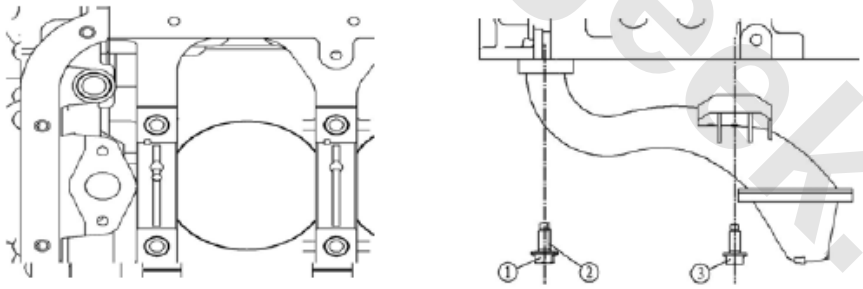


A-A B-B C-C

10.5.5 Install the oil pump and the timing chain box assembly with bolt tightening torque of M6:8 to 12N·m, M10:40 to 50N·m.

10.6 Oil Filter Installation Instructions

Tighten bolts step by step as shown in the following figure.



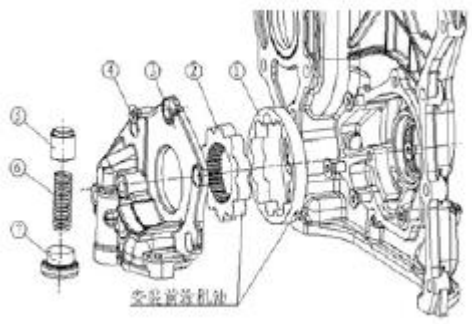
10.7 Oil Pump Disassembly and Assembly Instructions

10.7.1 Remove the oil pump and the timing chain box assembly (see content of the oil pump and the timing chain box).

10.7.2 Disassemble the oil pump as shown in the following figure.

10.7.3 Assemblethe oil pump in an order reverse to disassembly.

1	Outer rotor (with oil applied before being installed)
2	Internal rotor (with oil applied before being installed)
3	Oil pump cover
4	Cap screw
5	Controlled piston



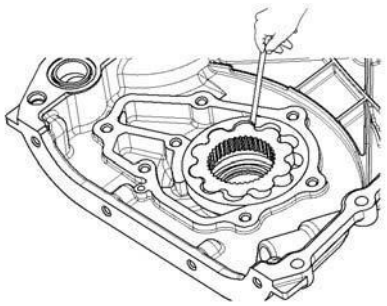
6	Pressure spring
7	Plug

10.8 Oil Pump Check

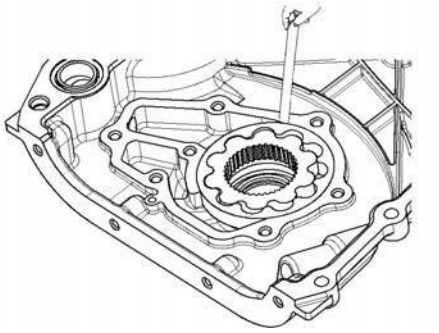
10.9 Rotor Clearance Check

10.9.1 Measure the following clearance. If necessary, replace the rotor or the pump body.

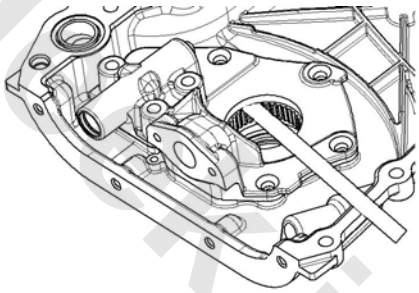
Standard top clearance of tooth: 0.06 - 0.20 mm
Maximum top clearance of tooth: 0.22 mm



Standard pump body clearance: 0.250 - 0.325
Maximum pump body clearance: 0.35 mm



Standard side clearance: 0.03 - 0.09mm
Maximum side clearance: 0.14 mm



10.10 Pressure Spring Check

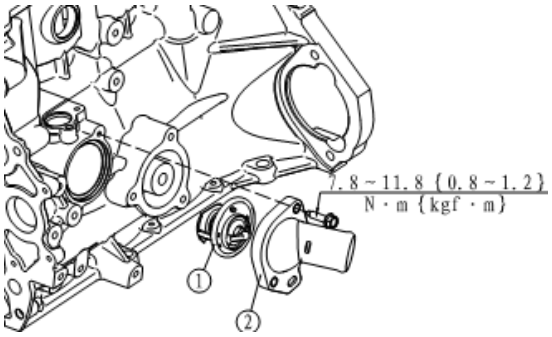
Check spring height.
Standard height: 50.5 mm
Check the opening pressure of the unloading valve by offering pressure to the oil pump.
Standard pressure: 400±20Kpa

11. Cooling System

11.1 Thermostat Removing and Installation

11.1.1 Remove it according to the sequence shown in the figure.

11.1.2 Install it in a reverse order to removing.



1	Thermostat cover
2	Thermostat See thermostat installation instructions.

11.2 Thermostat Removing and Installation Instructions

11.2.1 Put the thermostat in a utensil with hot water. Insert a thermometer in the water to heat it, and then check the thermostat.

Replace the thermostat if it is not in accordance with regulations.

- The valve turns off in room temperature.
- The valve turns on after being heated.

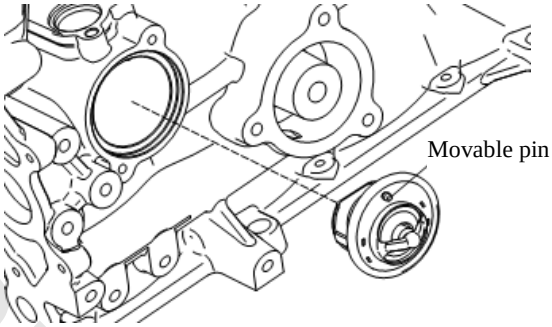
Open temperature (℃): 82

Full open temperature (℃): 95

Full open stroke (mm) ≥8.5

11.2.2 As shown in the figure, make sure that the thermostat is moving upwards.

11.2.3 Install the thermostat on the cylinder body through aligning to the thermostat installation port.

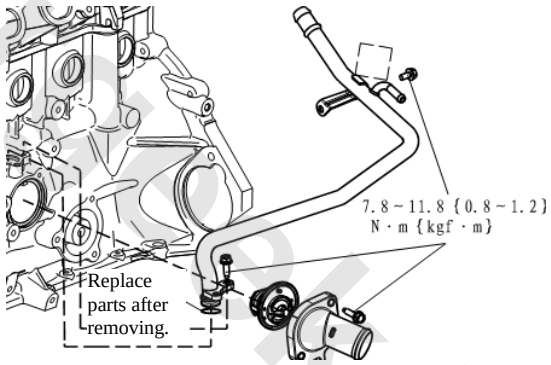


11.3 Cooling Water Pipeline Removing and Installation

11.3.1 Remove the thermostat (see content of thermostat removing/installation in this section).

11.3.2 Remove it according to the sequence shown in the figure.

11.3.3 Install it in a reverse order to removing.

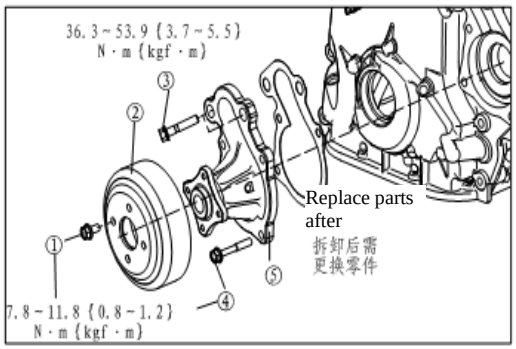


11.4 Water Pump Removing/Installation

11.4.1 Remove the generator belt (see content of generator belt).

11.4.2 Remove it according to the sequence shown in the figure.

11.4.3 Install it in a reverse order to removing.



1	Bolt (water pump pulley)
2	Water pump pulley
3	Bolt (water pump assembly)
4	Bolt (water pump assembly)
5	Water pump assembly

12. Cylinder Cover and Valve Mechanisms

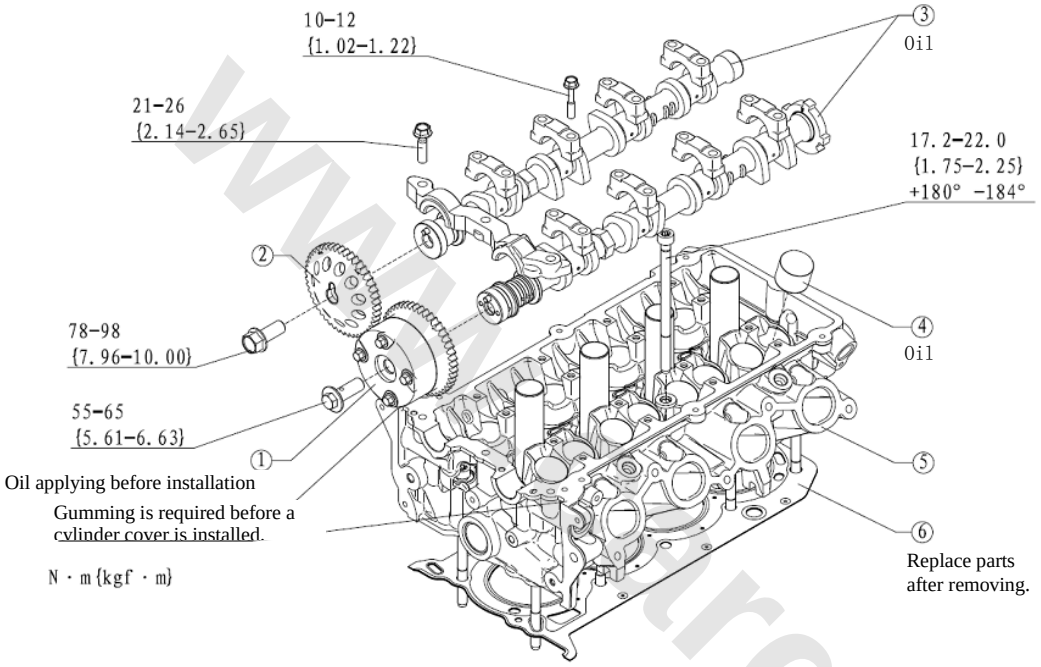
12.1 Cylinder Cover Removing and Installation

12.1.1 Remove intake and exhaust manifolds (see content of the intake/exhaust system).

12.1.2 Remove the timing chain (see content of the time chain).

12.1.3 Remove it according to the sequence shown in the figure.

12.1.4 Install it in a reverse order to removing.



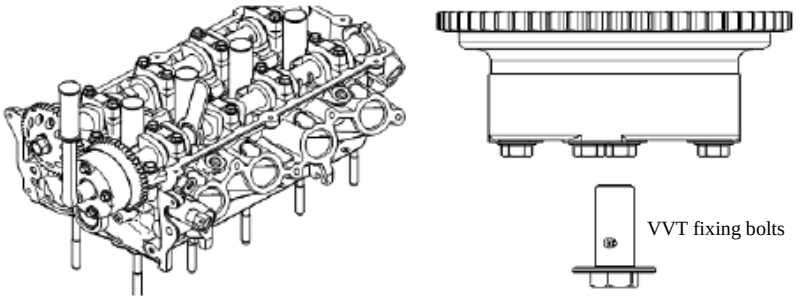
1	Intake VVT (see removing/installation instructions)
2	Camshaft sprocket (see removing/installation instructions)
3	Camshaft (see removing/installation instructions)
4	Tappet
5	Cylinder cover (see removing/installation instructions)
6	Cylinder cover gasket

12.2 Intake VVT Removing Instructions

12.2.1 As shown in the figure, use a wrench to stuck the six corner of the camshaft, and remove bolts of the intake VVT and camshaft sprocket.

12.2.2 Remove the VVT fixing bolts.

12.2.3 Shake the VVT gently and carefully remove it from the camshaft.



12.3 Camshaft Removing Instructions

12.3.1 Check and adjust the valve clearance if necessary (see valve clearance check in this section).

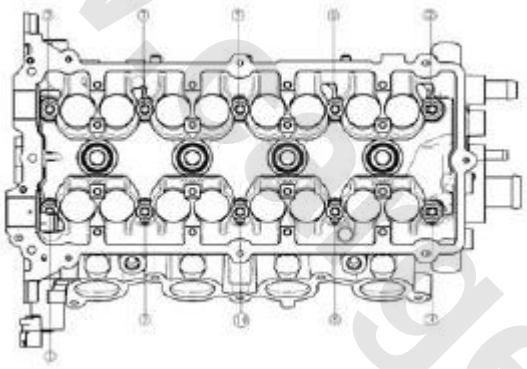
12.3.2 Check camshaft end clearance (see camshaft check in this section).

12.3.3 Check camshaft journal clearance (see camshaft check in this section).

12.3.4 Camshaft bearing seat bolts are loosened step by step according to sequence shown in the figure. First, loosen the front camshaft cover bolts, and then bolts of each camshaft cover.

12.4 Cylinder Cover Removing Instructions

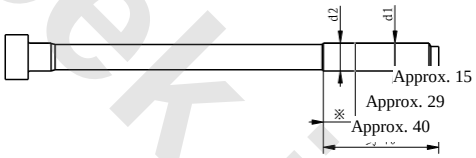
Loosen cylinder cover bolts in steps according to the sequence shown in the figure.



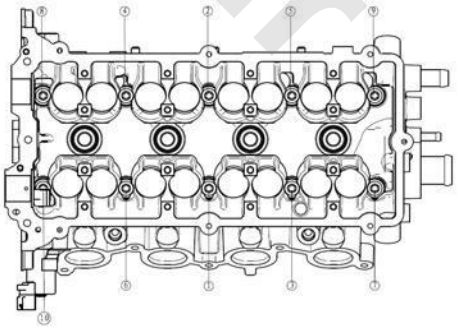
12.5 Cylinder Cover Installation Instructions

12.5.1 Measure the length of each cylinder cover bolt, and replace those with length exceeding the standard value. Measure external diameter difference (d1-d2) of each cylinder cover bolt and replaced bolts with difference exceeding 0.15 mm.

Note: D2 is the smallest external diameter in the range indicated by ※.

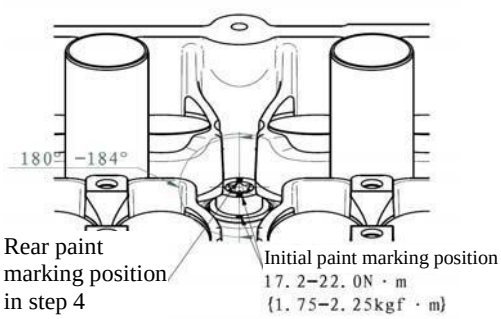


12.5.2 Tighten cylinder cover bolts to the specified torque in steps according to the sequence shown in the figure. Tightening torque: 24.5 N·m{1.75 - 2.25 kgf·m}



12.5.3 Mark on the head of each bolt.

12.5.4 Rotate each bolt for 180° by taking the mark as a base according to bolt tightening sequence shown in the figure in step 2, as shown in the following figure.



12.6 Camshaft Installation Instructions

Caution

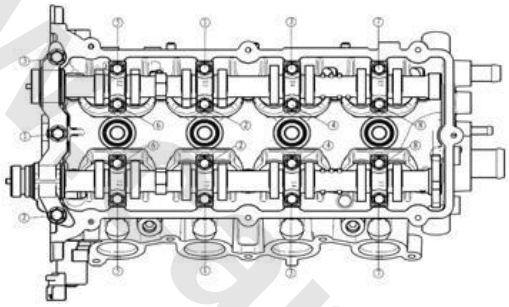
Installation clearance of a camshaft is small, so camshaft bearing journal must be tightly attached to the bearing seat during installation. Otherwise, high shaft and bearing contact surface pressure may cause damages. To prevent the above damages, the following regulations must be obeyed:

12.6.1 Apply a little oil on the camshaft journal and the bearing seat.

12.6.2 Put the camshaft in the camshaft bearing seat to make that the journal to tightly attach to the bearing seat.

12.6.3 The camshaft cover is arranged in sequence on its corresponding journal.

12.6.4 According to tightening sequence shown in the figure, tighten the bolt of each camshaft cover and then tighten bolts of front cam bearing.

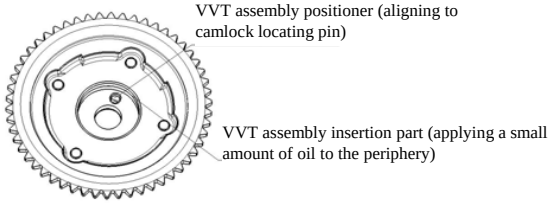


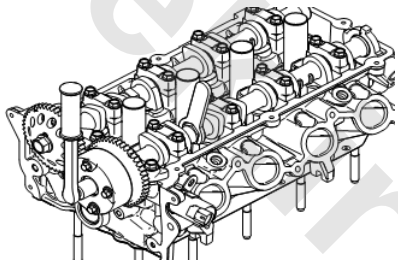
12.7 VVT Installation

12.7.1 Rotate the camshaft to make the locating pin upwards.

12.7.2 Apply a small amount of oil on the periphery of the VVT assembly insertion part, so that the VVT assembly locating hole is aligned with the camshaft positioning pin and the VVT assembly is slowly inserted.

12.7.3 As shown in the figure, use a wrench to stick the 6th corner of camshaft. Tighten VVT fixing bolts.



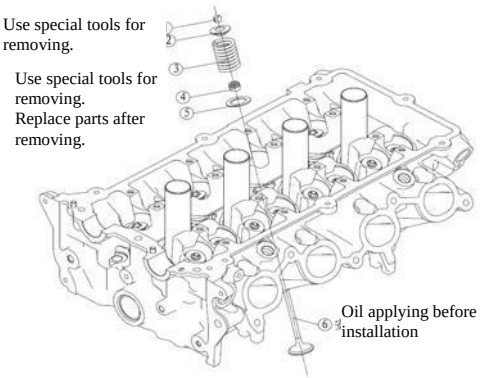


12.8 Valve Mechanism Removing and Installation

12.8.1 Remove the cylinder cover (see content of the removing of the cylinder cover).

12.8.2 Remove it according to the sequence shown in the figure.

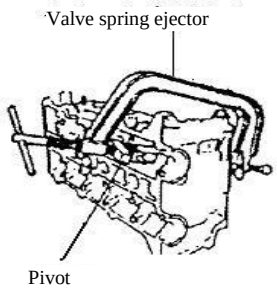
12.8.3 Install it in a reverse order to removing.



1	Valve card (see removing/installation instructions)
2	Valve spring upper seat
3	Valve spring (see installation instructions)
4	Valve oil seal
5	Valve spring lower seat
6	Valve (see removing/installation instructions)

12.9 Valve Card Removing Instructions

Use special tools to press the valve spring seat and remove the valve card.

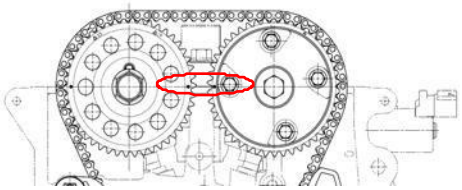


12.10 Valve Clearance Check Instructions

12.10.1 Remove the cylinder cover (see content of the cylinder cover removing).

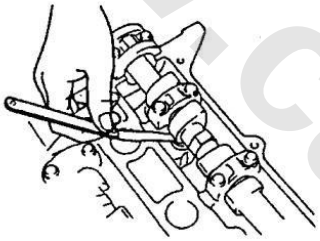
12.10.2 Confirm that the engine is cooled.

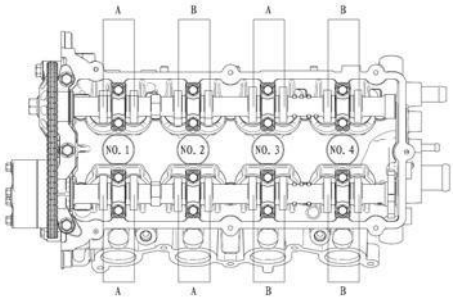
12.10.3 Measure valve clearance.



(1) Clockwise rotate the crankshaft and place the piston at the TOC of cylinder No.1. Namely, the gas distribution mark should be in the position shown in the left figure.

(2) Use a filler gauge to measure valve clearance of each cylinder for mark A in the figure.





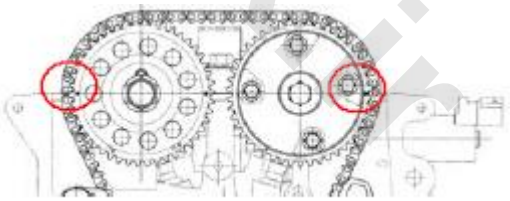
If valve clearance exceeds the standard value, the tappet is replaced (see the adjustment of the valve clearance).

Standard value of valve clearance (engine in cooling state)

Intake: 0.18 - 0.26 mm

Exhaust: 0.26 - 0.34 mm

(3) Clockwise rotate the crankshaft for 360° and place the piston at the TOC of cylinder No.4. Namely, the gas distribution mark should be in the position shown in the following figure.



Use a filler gauge to measure valve clearance of cylinders marked with B. If clearance exceeds the standard value, the tappet is replaced (see the adjustment of the valve clearance). Standard value of valve clearance (engine in cooling state)

Intake: 0.18 - 0.26 mm

Exhaust: 0.26 - 0.34 mm

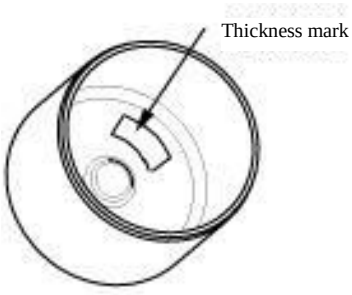
12.10.4 Install the cylinder cover (see content of timing chain and installation of cylinder cover).

12.11 Instructions About Valve Clearance Adjustment

Perform the following operations for all valves that require clearance:

12.11.1 Clockwise rotate the camshaft.

12.11.2 Remove the camshaft (see camshaft removing in this section).
12.11.3 Remove a tappet in clearance that requires adjustment.
12.11.4 Select a proper tappet. New tappet thickness = Old tappet thickness + Measured valve clearance - Standard valve clearance
(Intake: 0.22 mm; exhaust: 0.30 mm)
12.11.5 Insert the selected tappet into the tappet hole.
12.11.6 Reconfirm valve clearance (see content of valve clearance and valve clearance check).



Attention

- **When no timing chain is installed and valve clearance is adjusted, you should keep the crankshaft keyway facing the side face to prevent the valve from hitting the piston top when valve clearance is adjusted.**
- **Tappet thickness is marked with 3-digit numbers on the inside of the tappet, as shown in the right figure.**

The following table lists relationships between tappet marks and thickness.

Mark	Thickness (mm)		Mark	Thickness (mm)		Mark	Thickness (mm)
270	2.70		292	2.92		314	3.14
272	2.72		294	2.94		316	3.16
274	2*74		296	2*96		318	3*18
276	2.76		298	2.98		320	3*20
278	2.78		300	3*00		322	3*22
280	2.80		302	3*02		324	3*24
282	2.82		304	3*04		326	3*26
284	2.84		306	3*06		328	3*28
286	2.86		308	3*08		330	3.30
288	2.88		310	3,10			
290	2.90		312	3.12			

12.12 Cylinder Cover Check and Repair

12.12.1 Check the cylinder cover and replace it when necessary.

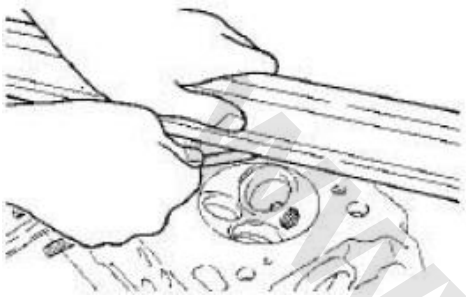
12.12.2 Check the following items and replace the cylinder cover if necessary.

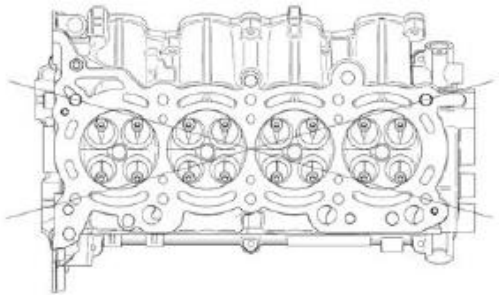
(1) Whether the valve seat is depressed.

(2) Whether the camshaft journal clearance or end clearance is excessively large.

12.12.3 As shown in the figure, use a knife straight edge and filler gauge to check whether the cylinder cover deforms in 6 directions.

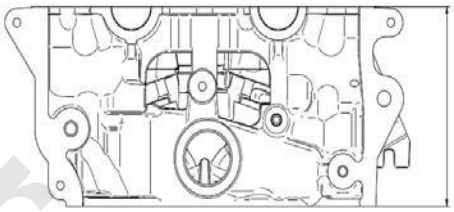
Maximum deflection: 0.06 mm





12.12.4 If the cylinder cover deformation exceeds the maximum value, check cylinder cover height; if the height is not within the standard value, replace the cylinder cover.

Standard height: 112.9-113.1mm

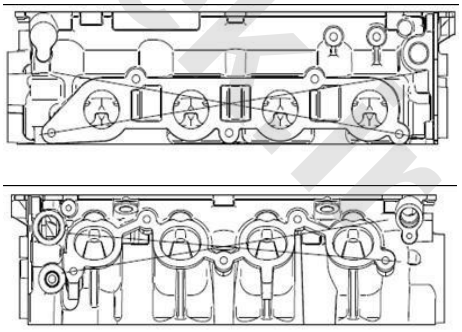


12.12.5 If the cylinder cover deformation exceeds the maximum value and the height is within the standard value, replace the cylinder cover or grind the height.

Maximum grinding height: 0.20 mm

12.12.6 As shown in the figure, use a knife straight edge and filler gauge to measure deformation of cylinder cover in directions of intake and exhaust manifolds.

Maximum deflection: 0.05mm



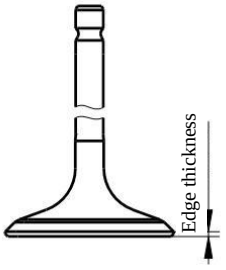
12.12.7 If it is measure that the deformation in step 6 exceeds the maximum value, grind the surface or replace the cylinder cover.

Maximum grinding height: 0.20 mm

12.13 Check on Valve and Valve Conduits

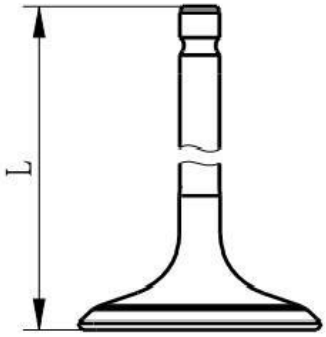
12.13.1 Measure valve head edge thickness of each valve and replace the valve if necessary.

Standard thickness: intake valve 1.2 mm; exhaust valve: 1.2 mm



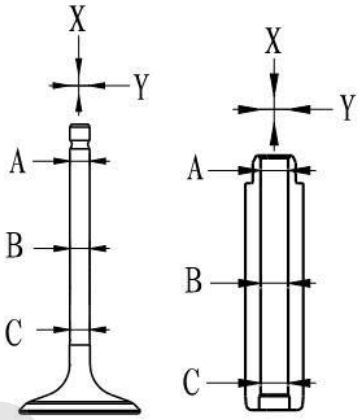
Minimum thickness: intake valve 0.8 mm; exhaust valve: 0.8 mm

12.13.2 Measure length of each valve and replace the valve if necessary.



Standard length
Intake valve: 89.6-90 mm
Valve exhaust: 90.2-90.6 mm
Minimum length
Intake valve: 89.4 mm
Exhaust valve: 90.0 mm

12.13.3 As shown in the figure, measure shank diameter of each valve in both X and Y directions at points A, B, and C. Replace the valve if necessary.

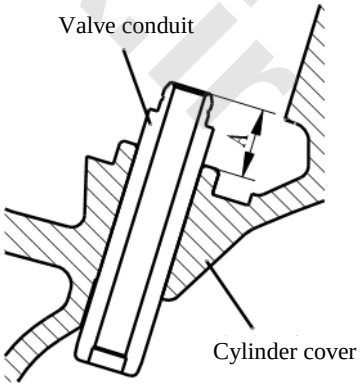


Normal diameter
Intake valve: 4.965-4.980mm
Exhaust valve exhaust: 4.955-4.970mm
Minimum diameter
Intake valve: 4.915mm
Exhaust valve: 4.905mm

12.13.4 You can measure inner diameter of each valve conduit in both X and Y directions at points A, B, and C, as shown in the figure. Replace the valve if necessary.

Standard inner diameter
Standard: 4.55-4.60 mm
Postprocessing: 5.0-5.012 mm

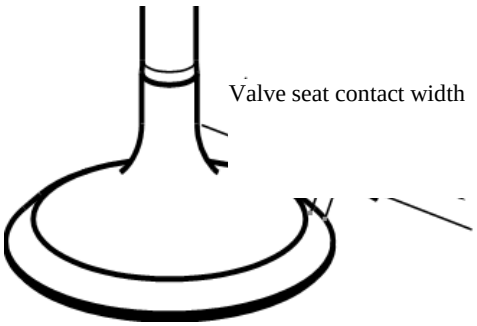
12.13.5 When no valve spring is installed, measure extension height of each valve conduit with dimension A. Replace the valve conduit if necessary.
Standard height: 12.7-13.3 mm



12.14 Valve Seat Overhaul Instructions

Measure the valve seat width using a method of surface coloring. If necessary, use a 44° gate seat tool to reprocess the valve or valve seat surface.

Normal width: 1.1-1.5 mm

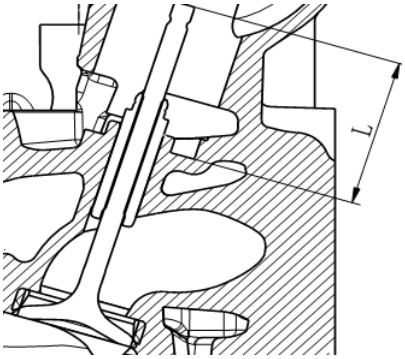


12.14.2 Check valve seat sinking. Measure extension length of a valve rod. Replace the valve if necessary.

Standard size L

Intake: 38.16 - 38.76 mm

Exhaust: 38.16 - 38.76 mm



12.15 Valve Spring Check Instructions

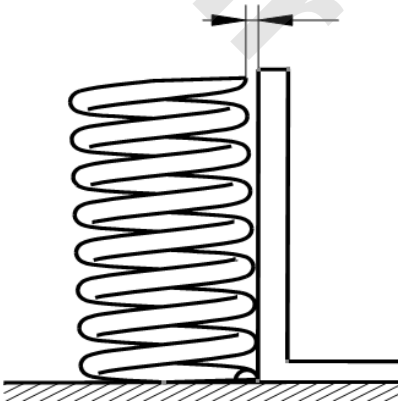
Put pressure on the valve spring using spring check tools, check spring height, and replace the valve spring if necessary. Press the valve to a certain height with a pressure value exceeding a given range, and then replace the valve spring.

When the height is 33.6 mm, the pressure is 139.2 to 158.8 N.

When the height is 24.9 mm, the pressure is 293.1 to 323.8 N.

12.15.2 Measure the perpendicularity of the valve spring. If the perpendicularity exceeds a standard vale, replace the valve spring.

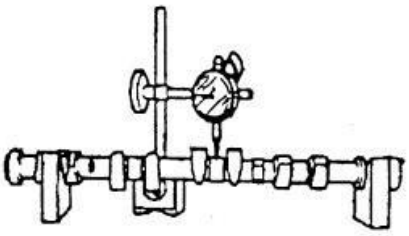
Maximum valve spring perpendicularity: 1.50 mm



12.16 Camshaft Check Instructions

12.16.1 Place journals 1 and 5 of the camshaft on block V, measure camshaft radial run-out, and replace the camshaft if necessary.

Radial run-out: 0.03 mm



12.16.2 Measure bulge height of two points, and replace the camshaft if necessary

Standard height

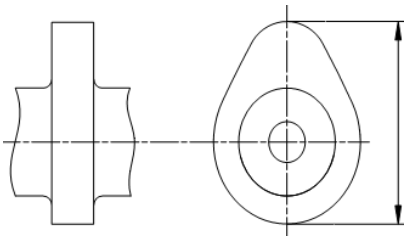
Intake: 44.71 mm

Exhaust: 44.28 mm

MI mum height

Intake: 44.41 mm

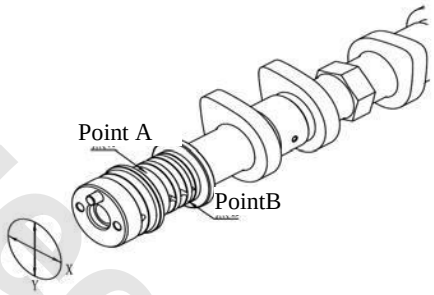
Exhaust: 43.98 mm



12.16.3 Measure journal diameters in both X and Y directions at points A and B, as shown in the figure. Replace the camshaft if necessary.

Normal diameter: 25.960-25.985 mm

Minimum diameter: 25.910 mm



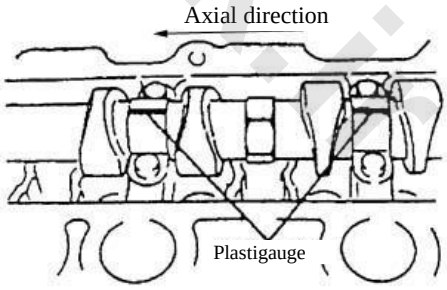
12.16.4 Remove the tappet and measure the camshaft journal clearance according to the following methods:

(1) Wipe off oil on the inner surface of the journal and bearing seat.

(2) Put the camshaft in the bearing seat.

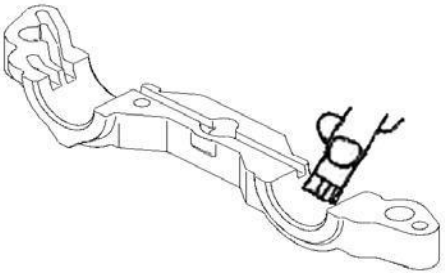
(3) As shown in the following figure, separate plastigage into that matching with bearing width, and then place it on the top of the journal along the axis direction.

(4) Install camshaft cover (see content of cylinder cover removing/installation and precautions for camshaft installation).



Attention

- Do not rotate the camshaft when measuring clearance.



(5) Remove camshaft cover (see content of cylinder cover removing/installation and precautions for camshaft removing).

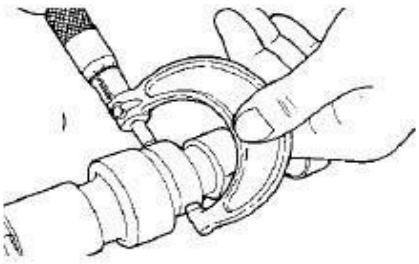
(6) Use a scale on the plastigage bag to measure the widest point on the squeezed part. Journal clearance is measured. If necessary, replace the cylinder cover and camshaft cover.

Standard journal clearance: 0.015-0.061 mm

12.16.5 Install camshaft cover (see content of cylinder cover removing/installation and precautions for camshaft installation).
12.16.6 As shown in installing dial gage in the following figure, push the camshaft at the front and rear sides of the camshaft and measure camshaft end clearance. If necessary, replace the cylinder cover or the camshaft.

Caution

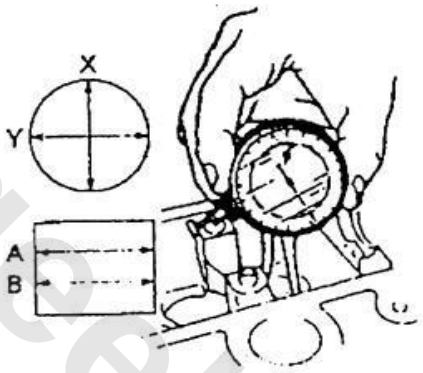
- Do not push the camshaft from the cam, so as not to damage the cam.



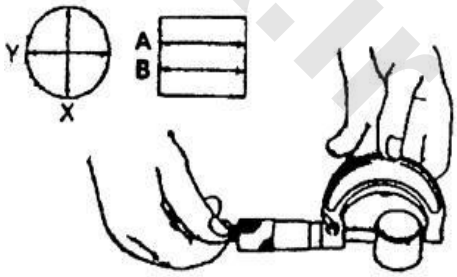
Standard end clearance: 0.08-0.20 mm
Maximum end clearance: 0.21 mm

12.17 Tappet Hole and Tappet Check Instructions

12.17.1 Measure the diameter of each tappet installation hole in both X and Y directions at points A and B shown in the figure.
Standard diameter: 31.000-31.025mm



12.17.2 Measure the diameter of each tappet in both X and Y directions at points A and B shown in the figure.
Standard diameter: 30.964-30.980 mm



12.17.3 Calculate clearance between the tappet and the corresponding tappet hole. Replace the tappet or valve cover if necessary.
Standard clearance: 0.020-0.061 mm
Maximum clearance: 0.180 mm

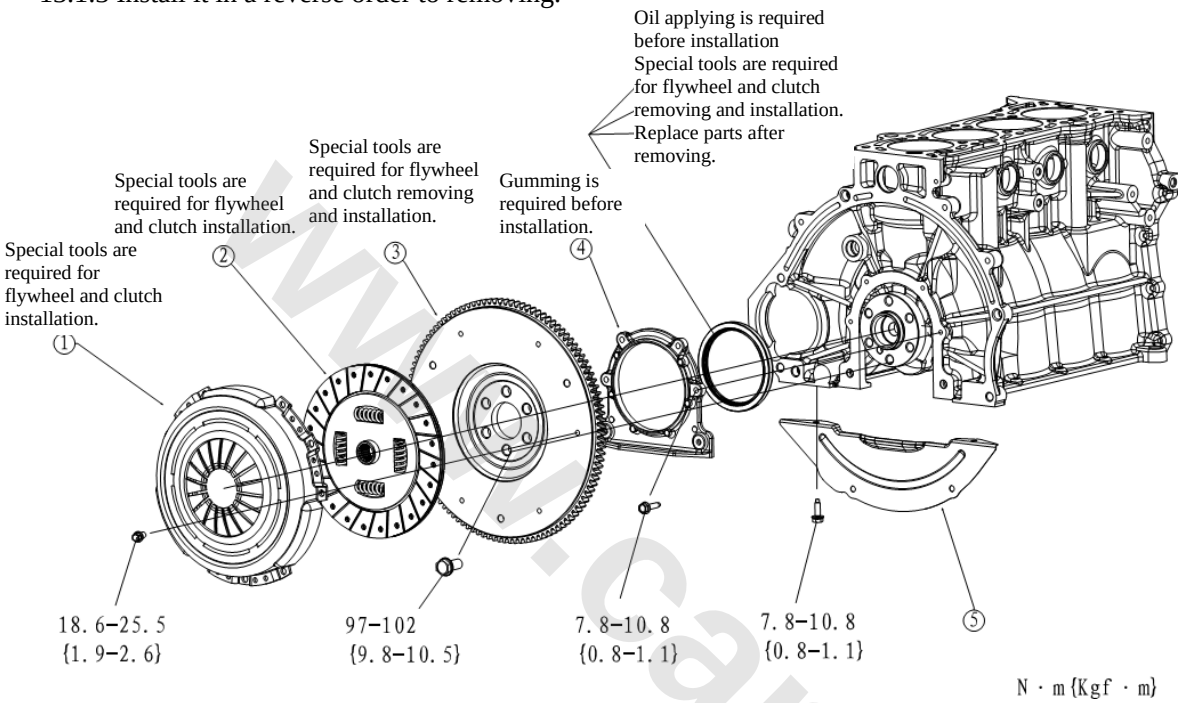
13 Flywheel and Clutch

13.1 Flywheel and Clutch Removing and Installation

13.1.1 If the crankshaft rear cover needs to be removed, the oil sump should be removed first (see content of the lubrication system, and removing and installation of the oil sump).

13.1.2 Remove it according to the sequence shown in the figure.

13.1.3 Install it in a reverse order to removing.



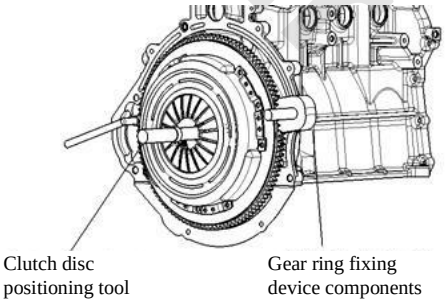
1	Clutch pressure plate (see removing/installation instructions)
2	Clutch friction plate (see removing/installation instructions)
3	Flywheel (see removing/installation instructions)
4	Crankshaft rear cover (see oil seal removing/installation instructions).
5	Transmission clapboard

13.2 Clutch Pressure Plate/Friction Plate Removing/Installation Instructions

13.2.1 Use special tools to stick the flywheel to locate the clutch (as shown in the figure).

13.2.2 The bolt is loosened by once in a cross way until the diaphragm spring pressure is released.

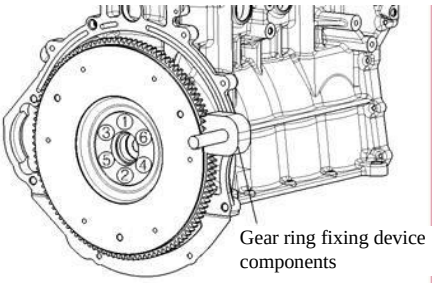
13.2.3 Remove the clutch pressure plate and friction plate.



13.3 Flywheel Removing Instructions

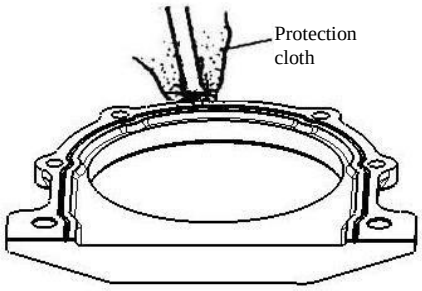
13.3.1 Use special tools to stick the flywheel.

13.3.2 Remove installation bolts uniformly through several times in a cross order (as shown in the figure). Remove the fly wheel.



13.4 Rear Oil Seal Removing/Installation Instructions

13.4.1 Wrap the screwdriver with protection cloth to remove oil seal.



Attention

- **Oil seals do not need to be removed, unless they need to be replaced.**

13.4.2 Fill clean oil on the oil seal openness.

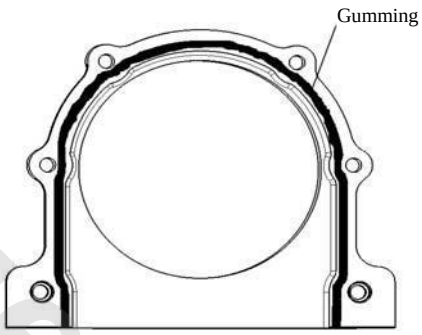
13.4.3 Manually install the oil seal.

13.4.4 Press into the oil seal with a special tool and a hammer.

Pressed depth: 0-0.5 mm

13.5 Installation Instructions of Camshaft Rear Cover

13.5.1 As shown in the figure, apply sealant to the groove on the rear cover of the camshaft.



Gum diameter: Φ1.5～Φ2.5 mm

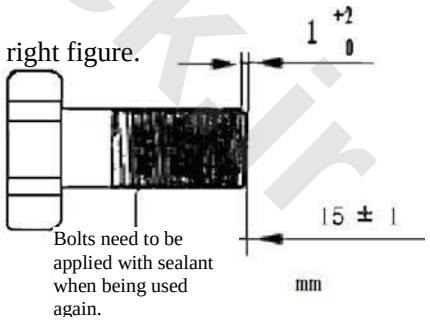
13.5.2 Install the camshaft rear cover.

13.6 Flywheel Removing/Installation Instructions

13.6.1 Install the flywheel on the camshaft.

13.6.2 Clean the threads and holes before installing the bolt, as shown in the right figure.

13.6.3 Apply sealant evenly to the thread.



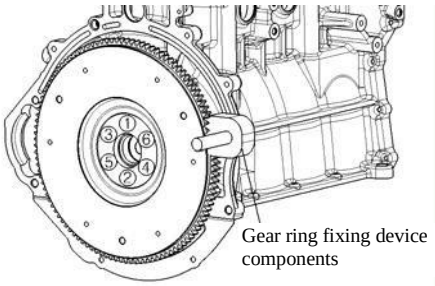
Attention

- **No more sealants need to be applied on new bolts.**

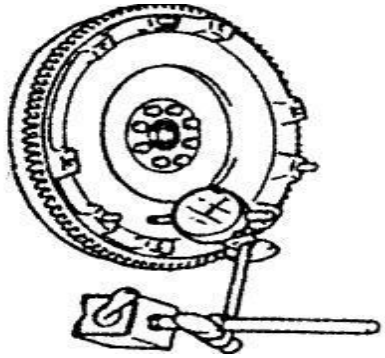
13.6.4 Tighten the fly wheel bolt manually.

13.6.5 Install special tools on the flywheel (as shown in the figure).

13.6.6 Tighten the flywheel bolt gradually in a cross order (as shown in the figure).

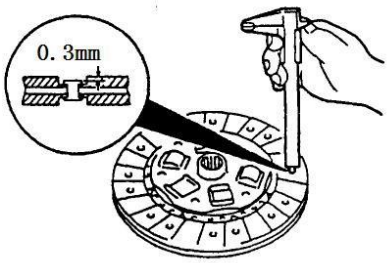


13.6.7 Install the dial gage on the cylinder body.
13.6.8 The flywheel is rotated to measure the radial circle run-out. If the run-out exceeds the standard value, the flywheel should be replaced. Maximum radial circle run-out: 0.13 mm

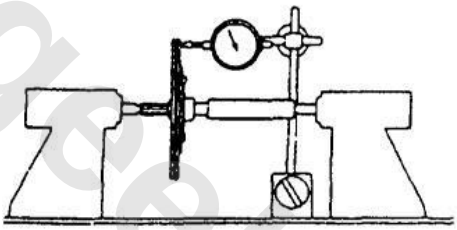


13.7 Clutch Friction Plate Check/Installation Instructions

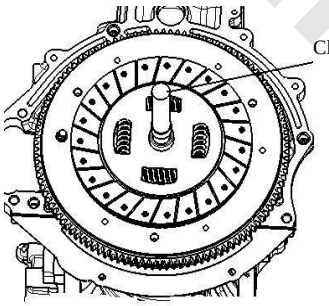
13.7.1 Measure depth between surfaces of rivets and friction plates on both sides with a vernier caliper. If the depth exceeds the standard vale, replace the clutch friction plate.
Minimum depth: 0.3 mm



13.7.2 Measure radial circle run-out of the clutch friction plate with a dial gage. If the depth exceeds the standard vale, replace the clutch friction plate.
Maximum radial circle run-out: 0.7mm

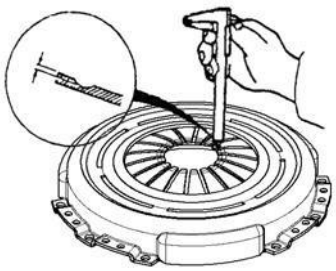


Maintain the position of the clutch friction plate with a special tool (as shown in the figure).

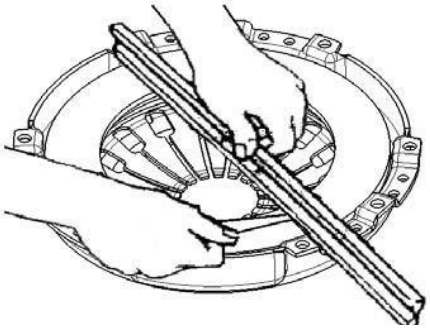


13.8 Clutch Pressure Plate Check/Installation Instructions

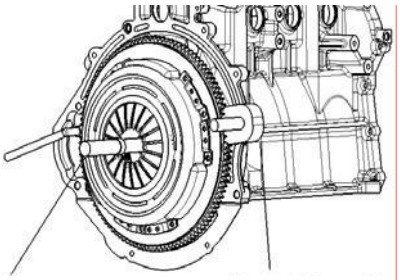
13.8.1 Measure wear of the diaphragm spring.
If the wear exceeds the standard vale, replace the clutch friction plate.
Maximum depth: 0.6 mm



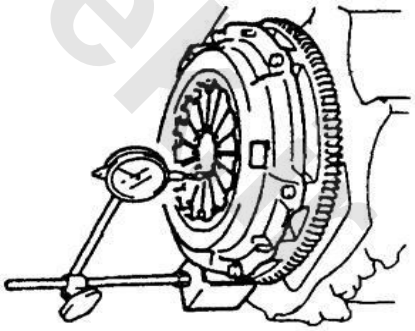
13.8.2 Measure the flatness of the pressure plate with a knife straight edge and a filler gauge.
If the wear exceeds the standard vale, replace the clutch assembly.
Maximum clearance: 0.05mm



13.8.3 Use special tools to stick the flywheel to locate the clutch (as shown in the figure).
13.8.4 Tighten the bolt evenly in a cross way through multiple times.



13.8.5 Install the dial gauge on the cylinder and rotate the flywheel to check the radial run-out of the diaphragm spring.
If the wear exceeds the standard vale, replace the clutch friction plate.
Maximum radial circle run-out: 0.8mm



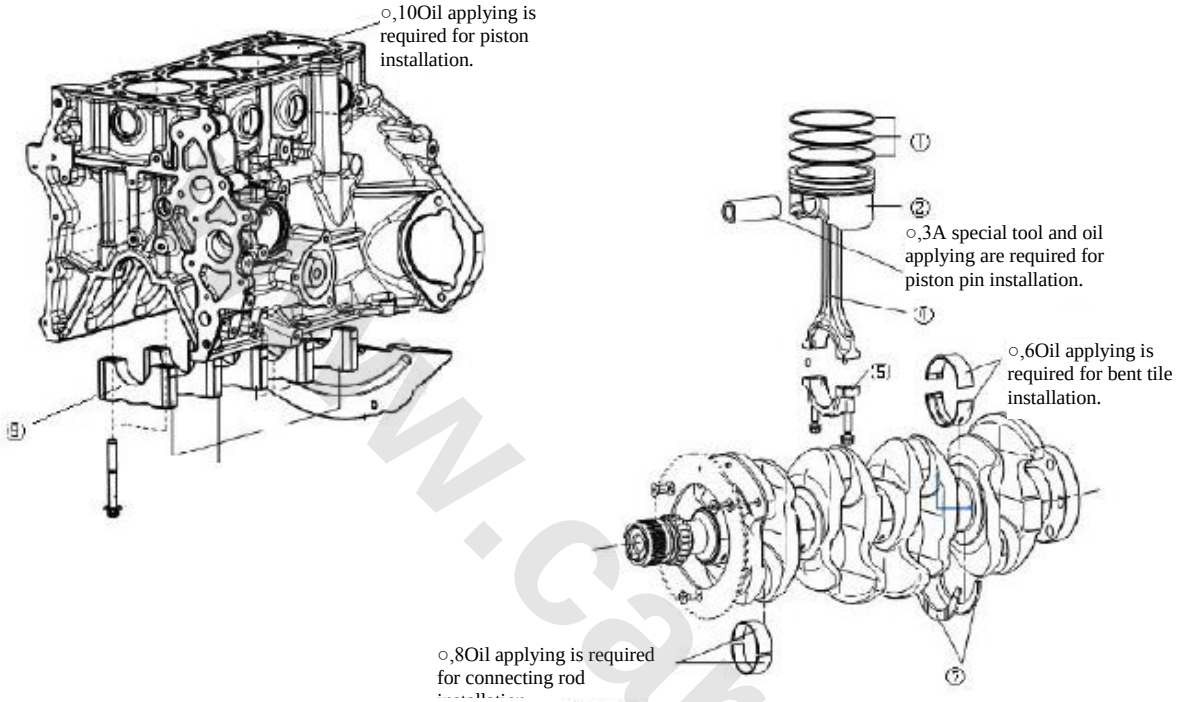
14. Cylinder Block and Connecting Rod

14.1. Cylinder Block and Connecting Rod Removing/Installation

14.1.1 Remove the cylinder cover (see content of cylinder cover), oil sump, oil pump (see content of lubrication system), crankshaft, and rear cover (see content of the flywheel and clutch).

14.1.2 Remove it according to the sequence shown in the figure.

14.1.3 Install it in a reverse order to removing.



1	Piston ring (see installation instructions)	6	Crankshaft bearing
2	Piston	7	Thrust bearing
3	Piston pin (see removing/installation instructions)	8	Connecting rod bearing
4	Connecting rod	9	Main bearing cover (see removing/installation instructions)
5	Connecting rod cover (see removing/installation instructions)	10	Cylinder

14.2 Connecting Rod Cover Removing Instructions

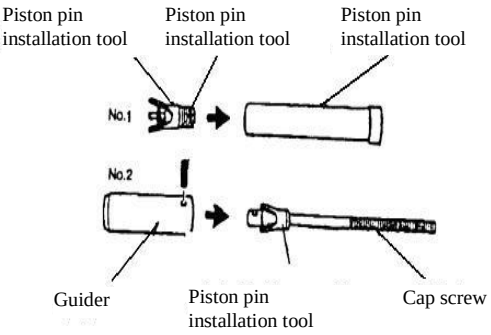
Check connecting rod end clearance (see connecting rod check in this section).

14.3 Piston and Connecting Rod Removing Instructions

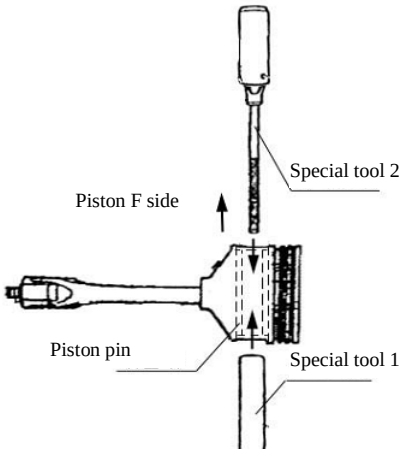
Check crank pin clearance (see connecting rod check in this section).

14.4 Piston Pin Removing Instructions

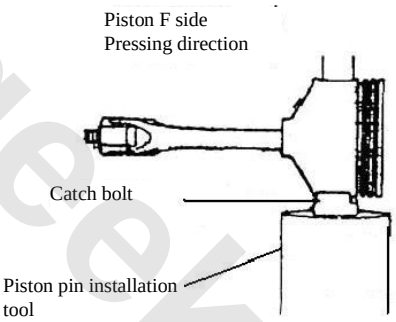
14.4.1 Install special tools 1 and 2, as shown in the figure.



14.4.2 As shown in the figure, insert special tool 2 into the piston pin and tighten it on special tool 1.



14.4.3 Install the installed special tool and piston connecting rod assembly in step 2 on the special tool shown in the following figure.

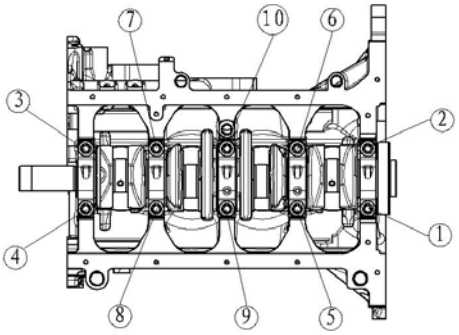


14.4.4 Press the piston pin out using the press machine.

14.5 Removing Instructions of a Main Bearing Cover

14.5.1 Check crankshaft end clearance (see crankshaft check/maintenance in this section).

14.5.2 Loosen the bearing cover bolt in steps shown in the figure.



14.6 Crankshaft Removing Instructions

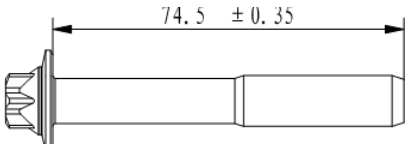
Check main journal clearance (see crankshaft check/maintenance in this section).

14.7 Installation Instructions of a Main Bearing Cover

14.7.1 Measure the length of bolt, and replace those with length exceeding the standard value.

Standard length: 74.15-74.85 mm

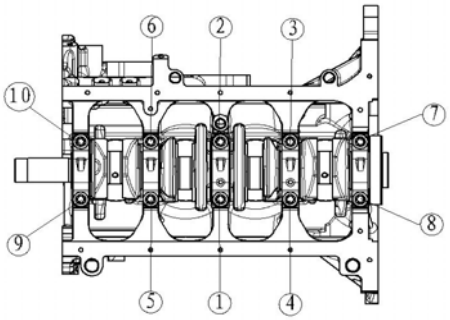
Maximum length: 70.05 mm



14.7.2 Tighten cylinder cover bolts to the specified torque in steps according to the sequence shown in the figure. Mark on each bolt head.

Tightening torque: 52 N·m

14.7.3 Rotate each bolt for 60° by taking the mark as a base according to bolt tightening sequence shown in the figure in step 2.



14.8 Piston Pin Installation Instructions

14.8.1 Install the piston pin with a special tool.

14.8.2 Measure length of the following items:

(1) A: External dimensions of piston pin lug boss

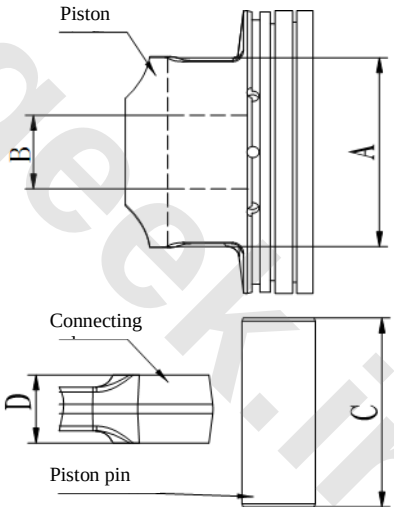
(2) B: Width dimensions of piston internal cavity open gear

(3) C: Piston pin length

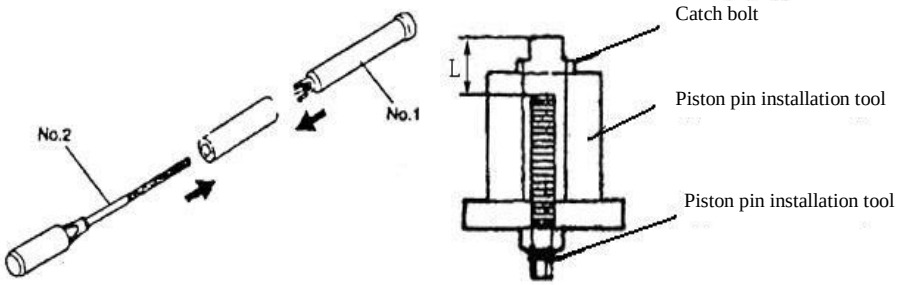
(4) Width of a small head of a connecting rod

(5) Use the measured value in the following formula:

$$h = \frac{B + C - A - D}{2}$$

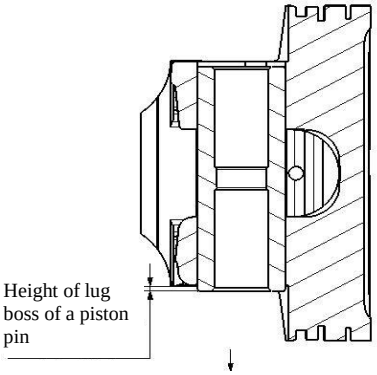


14.8.3 Insert special tool 2 into the piston pin and tighten it on special tool 1.

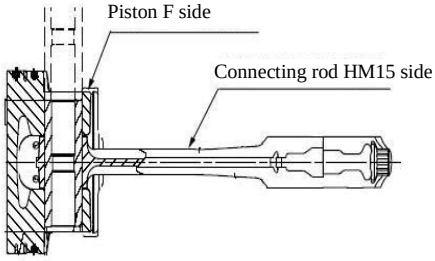


14.8.4 The special installation tool (catch bolt) makes the size of the L to be proper, that is, the size meets

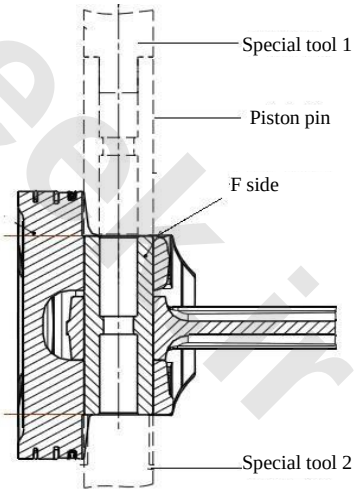
requirements of piston pin lug boss extruded from any end of the piston after press fitting.
Height: H=h±0.15 is within 0.250±1.275mm.



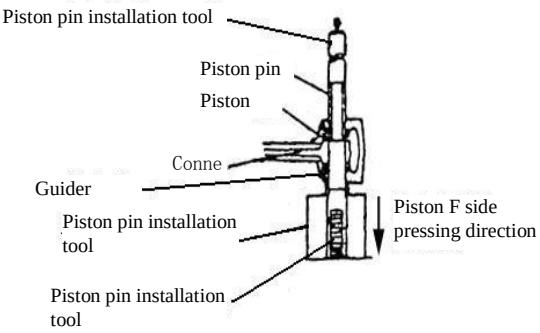
14.8.5 Apply clean engine oil on the piston pin.
14.8.6 Place the piston and connecting rod on the press fitting table so that the piston "F" side and the connecting rod arrow face the logo side, as shown in the following figure.



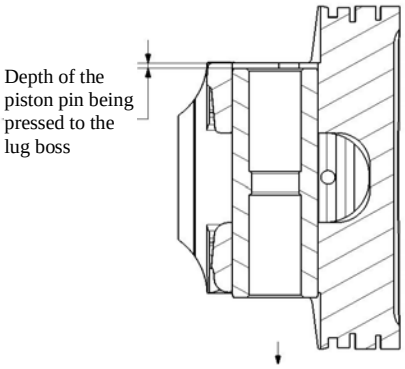
14.8.7 Insert the piston pin and special tool installed in step 2 into the piston and connecting rod, as shown in the following figure.



14.8.8 Press the piston pin into the piston and connecting rod using the press machine until special tool 2 (conduit) contacts the special tool (catch bolt).
14.8.9 Check pressure when pressing the piston. If the pressure is less than the indicator, replace the piston pin and the connecting rod.
Pressure: 5-11 kN (510-1122kgf)



14.8.10 Check the pressed depth of the piston pin. If the depth does not meet the requirement, operate from step 1.
Piston pin pressed depth: 0.550-1.075 mm



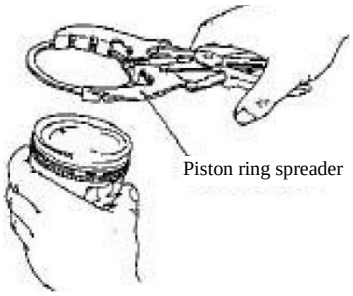
14.9 Piston Ring Installation Instructions

14.9.1 As shown in the following figure, install the corrugated ring into the piston ring groove, install one end of the oil scraper into the slot, and press other parts in place.
Check whether each scraper can slide in two directions.

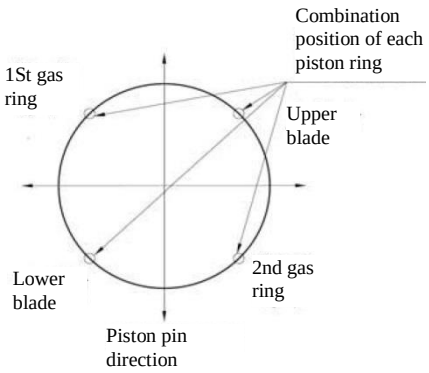
Caution

- **Do not install the oil scraper with the piston ring expander, or the scraper may be broken.**

14.9.2 Use a piston ring spreader to install the 1st and 2nd piston rings. The marks face upwards during installation.



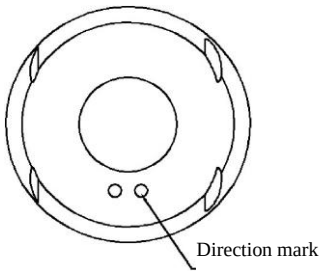
14.9.3 Align openness of each ring according to the following figure.

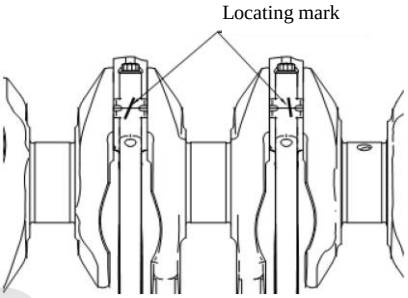


14.10 Installation Instructions of Piston Connecting Rod Assembly

14.10.1 Piston marks face the front part of the engine.

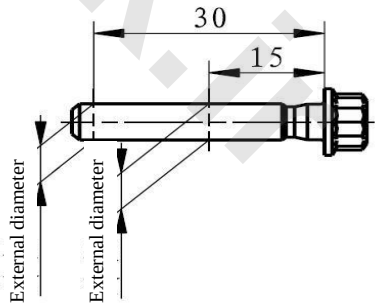
14.10.2 Align positioning marks of connecting rod covers during installation.





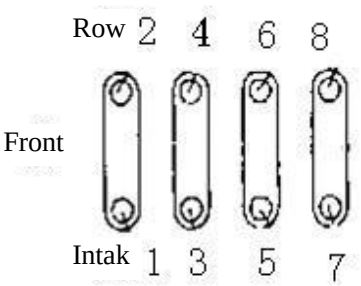
14.11 Installation Instructions of a Connecting Rod Cover

14.11.1 A bolt can be reused. When difference between two points shown in the figure exceeds 0.1 mm, the bolt cannot be used.



14.11.2 Tighten connecting rod bolts to the specified torque in steps according to the sequence shown in the figure.

Tightening torque: 5 N·m

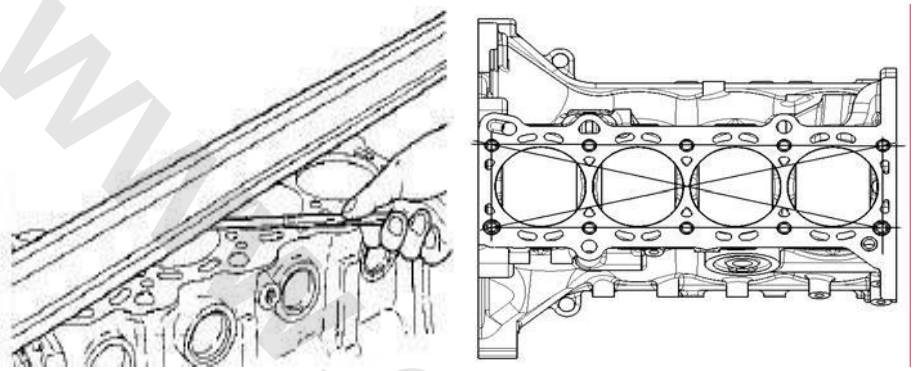


14.11.3 Tighten bolts again according to the above sequence.

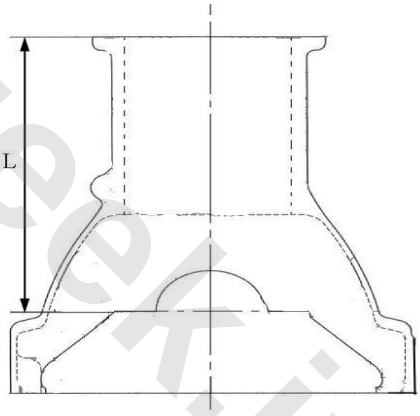
Tightening torque: 15 N·m

14.11.4 Mark on the head of each bolt.
14.11.5 Rotate each bolt for 90° by taking the mark as a base according to bolt tightening sequence shown in the figure in step 2.

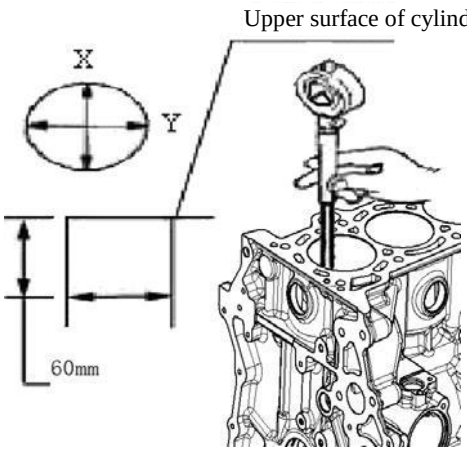
14.12 Cylinder Check/Repair
14.12.1 Use a knife straight edge and filler gauge to check deformation of the cylinder cover in 6 directions shown in the figure.
Cylinder maximum deflection: 0.1mm



14.12.3 If the cylinder deformation exceeds the maximum value, check cylinder cover height; if the height is not within the standard value, replace the cylinder cover.
Standard height: 204.95-205.05 mm



14.12.3 If the cylinder deformation exceeds the maximum value and the height is within the standard value, replace the cylinder or grind the height. Maximum grinding height: 0.20 mm
14.12.4 As shown in the following figure, measure cylinder inner diameters in both X and Y directions and at a position of 60 mm to the upper surface using an internal dial gauge.



14.12.5 If the wear of cylinder internal diameter exceeds the limit, replace the cylinder or rebore cylinder and install a piston with a large size. Then, the standards are met.
Clearance between a piston and cylinder Wear limit: 0.135 mm

Attention

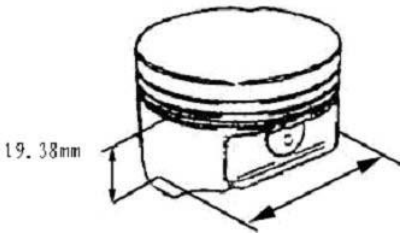
- **Rebore diameter should be determined according to the diameter of a large piston. All cylinders must be in the same diameter.**
- **In order to prevent cylinder deformation due to heat generation for boring, bore cylinder holes according to the following order: 2 - 4 - 1 - 3.**
- **Reserve a honing margin of 0.02 mm during boring. Hone the cylinder hole to the final processed dimension.**

Inner diameter of cylinder (mm)

Dimensions	diameter
Standard	74.8 - 74.815
0.50 increase the dimension	75.05-75.065
0.50 increase the dimension	75.3-75.315

14.13 Piston, Piston Ring, and Piston Pin Check

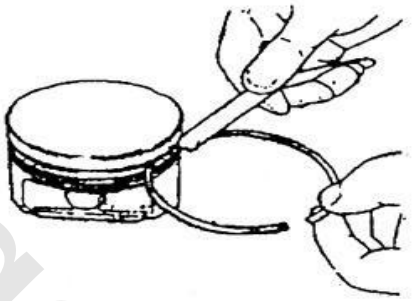
14.13.1 Measure the piston diameter at a location of 19.38 mm below the oil control ring groove in the direction vertical to the pin hole axis.



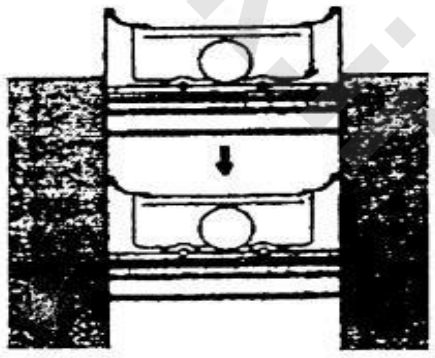
Piston diameter (turn)

Dimensions	diameter
Standard	74. 775 - 74. 785
0.25 increase the dimension	75. 025 - 75. 035

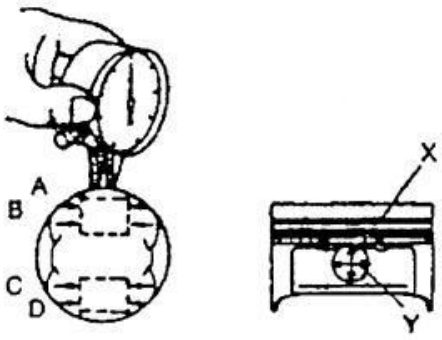
14.13.2 Calculate clearance between a piston and cylinder. Replace the piston or boring cylinder when necessary in order to apply a piston with a larger size.
Standard clearance: 0.01-0.035 mm
Maximum clearance: 0.095mm
14.13.3 If a piston is replaced, the piston ring must be replaced at the same time.
14.13.4 Measure clearance between the piston ring and ring groove on the perimeter using a filler gauge. Replace the piston and piston ring if necessary.
Standard clearance
First ring: 0.030-0.070 mm
Second ring: 0.020-0.060 mm
Oil ring 0.040-0.15 mm
Maximum clearance
First ring and second ring: 0.15 mm
Oil ring: 0.18 mm



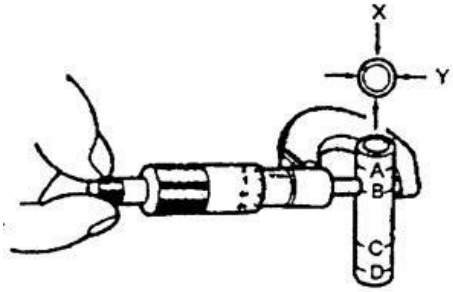
14.13.5 Put the piston ring in the cylinder with your hand and push the piston ring to the bottom of the cylinder hole stroke with the piston.
14.13.6 Measure open clearance of each piston ring with a filler gauge. Replace the piston ring if necessary.
Standard open clearance:
First ring: 0.15-0.30 mm
Second ring: 0.30-0.50 mm
Oil ring: 0.10-0.60mm
Maximum open clearance: 1.0 mm



14.13.7 Measure the diameter of each piston pin hole in both X and Y directions at points A, B, C, D as shown in the figure.
Standard diameter: 18.010-18.014mm



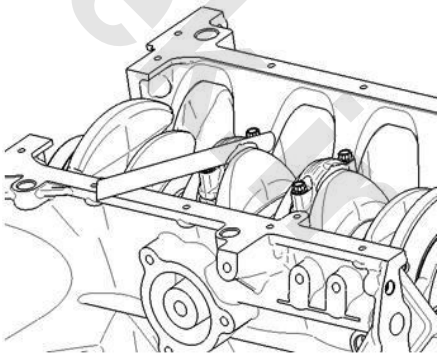
14.13.8 Measure the diameter of each piston pin in both X and Y directions at points A, B, C, D as shown in the figure.
Standard diameter: 18.001-18.005 mm



14.13.9 Calculate clearance between piston pin and piston pin hole and replace the piston pin and piston pin hole, if necessary. Standard clearance: 0.005-0.013mm
14.13.10 Measure the diameter of the small head of the connecting rod (see content of connecting rod check), and calculate clearance between the small head of the connecting rod and the piston pin. Replace the connecting rod or the piston pin if necessary.
Standard clearance: -0.031 - -0.016mm

14.14 Connecting Rod Check

14.14.1 Measure connecting rod clearance. Replace the connecting rod or the cover if necessary.
Standard clearance: 0.100-0.350 mm
Maximum clearance: 0.40 mm

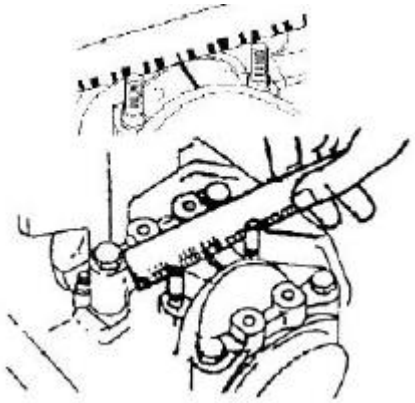


14.14.2 Measure crankshaft pin journal clearance according to the following methods:
(1) Wipe off oil on the inner surface of the journal and bearing seat.
(2) Separate plastigage into that matching with bearing width, and then place it on the top of the journal paralleling to the axis direction.
(3) Install the connecting rod cover (see installation of piston and connecting rod in this section).
(4) Remove the connecting cover bolt and take the cover slowly.
(5) Use a scale on the plastigage to measure the widest point on the squeezed part. Journal clearance is measured. If the clearance exceeds the maximum value, replace the connecting rod bearing or grind crankpin. Besides, use a

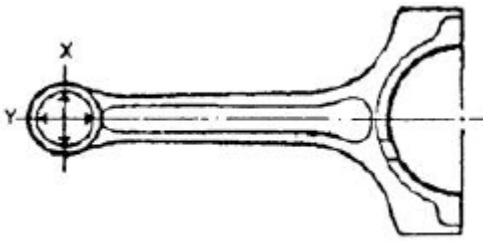
bearing bush applying to crankpin dimension reduction, to adapt to standard clearance.
Standard clearance: 0.014 - 0.058mm
Maximum clearance: 0.10mm

(mm)

Connecting rod bearing dimensions	Connecting rod bearing thickness
Standard	1.485-1.496
0.25 increase the dimension	1.610-1.621
0.50 increase the dimension	1.735-1.746

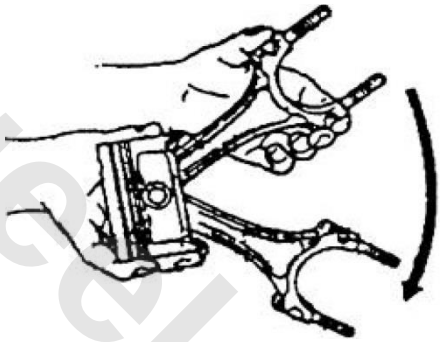


14.14.3 Measure inner diameter of a small head of each cylinder in both X and Y directions, as shown in the figure.
Standard diameter: 17.974-17.985mm



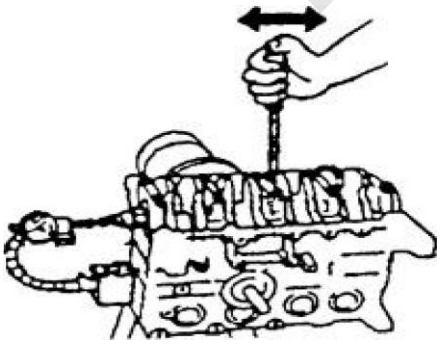
14.15 Check on Piston Connecting Rod Assembly

Check the swivel torque, as shown in the figure. If a big head cannot be removed based on weight, replace the piston and piston pin.



14.16 Crankshaft Check/Repair

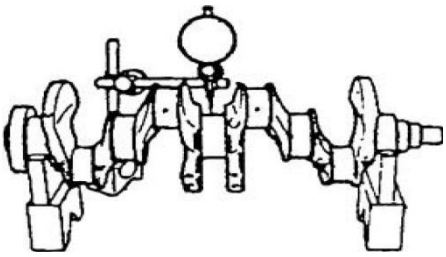
14.16.1 As shown in the dial gage shown in the figure, use a screwdriver to push the crankshaft frontwards and backwards and measure crankshaft end clearance. If the end clearance exceeds the maximum value, replace the thrust bearing or grind the crankshaft. Besides, Install a proper bearing bush to reduce the crankpin to a proper size to apply to standard end clearance.
Standard end clearance: O.08 O.255mm
Maximum end clearance: O.350mm



(mm)

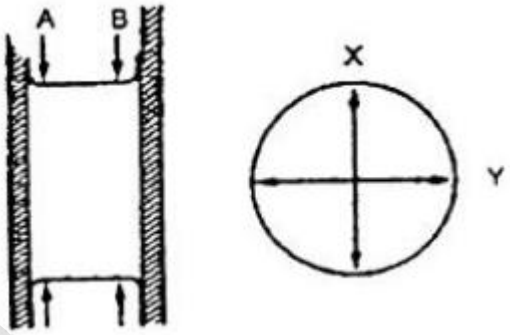
Thrust bearing	Thrust bearing
Standard	3.232 - 3.260
0. 25 Increase the	3.357 - 3.385
0. 50 Increase the	3.482-0.510
0. 75 Increase the	3.607 - 3.635

14.16.2 Measure crankshaft radial run-out of a crankshaft. Replace the crankshaft if necessary.
Maximum radial circle run-out: 0.03mm



14.16.3 Measure journal diameters in both X and Y directions at points A and B, as shown in the figure. Replace the crankshaft or the grinding journal if necessary and install a bearing bush applying to crankshaft size decreasing.

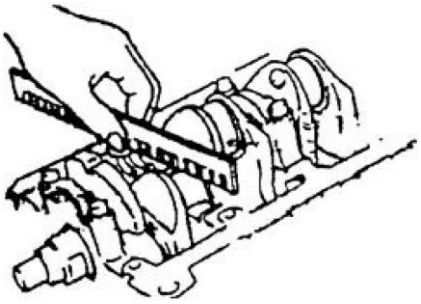
Main journal	Diameter (mm)
Standard	45. 982 - 46
0. 25 Decrease the dimension.	45. 732 - 45. 75



Crankpin	Diameter (mm)
Standard	39. 980 - 40. 000
0.25 Decrease the dimension.	39. 730 - 39. 750
0.50 Decrease the dimension.	39. 480 - 39. 500

14.16.4 Measure main journal clearance according to the following methods:
(1) Clean oil on the internal surface of the crank journal and bearing block.
(2) Separate plastigage into that matching with bearing width, and then place it on the top of the journal paralleling to the axis direction.
(3) Install the main bearing cover (see content of bearing cover installation in this section).
(4) Remove the bearing bolt and take down the bearing cover slowly (see content of bearing cover installation in this section).
(5) Use a scale on the plastigage to measure the widest point on the squeezed part. Journal clearance is measured. If the clearance exceeds the maximum value, grind the main bearing hole and install a bearing bush applying to crankshaft dimension reduction, to adapt to current clearance.
Standard clearance: 0.018 - -0.036mm
Maximum clearance: 0.l mm

Bearing dimension	Bearing thickness
Standard	1.971 - 1.996
0. 0.25 Increase the dimension.	2.096 - 2.121



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