



# UNI-K

- **Engine system**

**UNI-KRM2A/1/1**

# Section 3

## Power

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### Model :UNI-K

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## 3.1.1 Engine system -2.0

### L

#### General

D20TG-AA engine is a front engine independently developed by Changan; Uphold the concept of "self-innovation, energy-saving, environmental protection, safety, fashion and classic products, economical and practical" in Changan; The features of "net, strong and quiet" are presented perfectly to meet the competitive advantages of the future Chinese market. After 2021, D20TG-AA engine will be the main power of medium and advanced SUVs in Chang'an. In order to ensure excellent performance of the engine, advanced design, manufacturing and technology are adopted in key systems to achieve outstanding fuel saving performance, good power performance, excellent NVH quality, high reliability and durability of the engine.

Advanced technology:

a) High efficiency combustion system

35MPa direct fuel injection system plus three injections

Middle VVT+ middle lock VVT+ timing chain system

Electronic control actuator + double scroll supercharger

Atkinson cycle

b) Low friction design

Crankshaft offset

Bearing bush, piston pin coating

Full variable displacement oil pump

Low viscosity oil

c) Advanced thermal management system

Block cylinder head parallel cooling

Thermostat water outlet control + HVAC control valve

Water-cooled intercooling system

Cylinder head integrated exhaust manifold(IEM)

d) Lightweight design

Plastic intake manifold

Cancel exhaust manifold

Lightweight design of crankcase and crankshaft

Superior quality:

In addition to using advanced technology, the D20TG-AA engine has undergone rigorous bench test and complete vehicle test. After repeated high-strength road reliability test and road test under various extremely severe working conditions such as high temperature, high cold and plateau, the quality of the engine is ensured.

◆ High performance: Maximum power 171KW, maximum torque 390N.m;

◆ Low emission: Meet national VI emission;

◆ Outstanding fuel-saving performance: Low friction, shortened warm-up time (advanced engine heat management);

◆ Excellent NVH quality;

◆ Reliability and durability;

◆ Reduce manufacturing cost, high cost performance;

◆ Compact size, concise appearance (Packaging), leading structure design, modular and integrated parts, reducing the number of parts;

• High maintenance performance, reduced maintenance costs.



**Warning:** Before removing or installing any electrical device, always disconnect the battery negative cable before the tools or equipment easily contact the exposed electrical terminals. Disconnect this cable to prevent injury or damage to the vehicle. If there is no special instruction, stop the ignition.



**Note:** Each time the air filter is removed, the air inlet must be blocked to prevent foreign matter from entering. Foreign matter may block the cylinder intake passage during starting and cause serious damage.



**Note:** For maintenance involving dismantling of "water pump and water pipe above generator," "cloth or other auxiliary articles shall be used to block the generator to prevent liquid from entering the generator."

## 3.1.2 On-board diagnosis

### On-board diagnostic system(OBD)

#### OBD System Description

When the system enters the working state and the engine runs, ECM controls the working of all parts of the system, and monitors the parts directly connected with it in real time. When one or several parts of the system work abnormally, the system will automatically give an alarm; Each fault state has a special code. Once a fault occurs, the system will output this code (i.e. fault code) through the diagnostic interface. Meanwhile, turn on "engine malfunction indicator lamp" to remind the vehicle driver to repair in time. The fault code indicates the possible fault position.

In case of fault, the system can also adopt temporary emergency plan to control engine operation to ensure that the user drives the vehicle to the maintenance station for maintenance without roadside anchoring.

#### Malfunction Indicator Lamp (MI) Description

A malfunction indicator is an indicator that alerts the vehicle driver when any emission-related component connected to the OBD system or the OBD system itself fails. As shown in the figure below:



#### Malfunction indicator function criterion

The malfunction indicator must be activated at the required time when a component or system malfunction causes vehicle emissions to exceed regulatory requirements. Depending on whether the fault affects emissions and its severity, activate the malfunction indicator according to the following criteria:

##### **Influence emission fault code:**

1. Once occurs, MI indicator lamp will be lit and fault code will be recorded.
2. Light and record the fault code only after two consecutive driving cycles occur once each.

##### **Emission fault code is not affected:**

Record the fault code when the fault occurs, but do not light the MI indicator.

##### **Malfunction lamp (MI) off:**

In three consecutive driving cycles, the MI is extinguished if the test system responsible for activating the MI no longer detects a fault and no other fault that will activate the MI alone is detected.

##### **Fault Code Clear:**

If the same fault no longer occurs in more than 40 engine warm-up cycles, the OBD system clears the fault code and the driving distance and freeze frame data information when the fault occurs.

Note: A driving cycle refers to a driving cycle in which all OBD tests can be completed and consists of engine starting, running and shutdown. Reference may be made according to the test procedure for national emission level VI (WLTC case).

### Fault code table

index	Pcode	FTB	Fault explanation
1	P0499	00	Canister vent valve control circuit voltage too high
2	P0498	00	Canister vent valve control circuit voltage too low
3	P0447	00	Canister vent valve control circuit open
4	P2422	00	Canister vent valve stuck closed
5	P0645	00	A/C Compressor relay control circuit open
6	P0647	00	A/C Compressor relay control circuit voltage too high
7	P0646	00	A/C Compressor relay control circuit voltage too low
8	P0563	00	Battery voltage too high
9	P0562	00	Battery voltage too low
10	P0558	00	Brake chamber vacuum pressure sensor voltage too high
11	P0557	00	Brake chamber vacuum pressure sensor voltage too low
12	P0571	00	Brake signal is out of sync
13	P1500	00	Vehicle receives crash cut-off signal
14	P1501	00	Airbag communication information is unreasonable
15	P1420	00	Can hardware register response timeout
16	P050C	24	Coolant temperature sensor 1 cold start calibration is unreasonable(Positive deviation)
17	P050C	23	Coolant temperature sensor 1 cold start calibration is unreasonable(Negative deviation)
18	P0119	00	Coolant temperature sensor 1 circuit voltage is unreasonable
19	P0116	23	Coolant temperature sensor 1 signal is unreasonable(Low side)
20	P0116	26	Coolant temperature sensor 1 signal is unreasonable(Sticky)
21	P0118	00	Coolant Temperature Sensor 1 Circuit High Voltage
22	P0117	00	Coolant Temperature Sensor 1 Circuit Low
23	P0597	00	Electronic thermostat control circuit open
24	P0599	00	Electronic thermostat control circuit voltage too high
25	P0598	00	Electronic thermostat control circuit voltage too low
26	P0128	00	Unreasonable thermostat performance(The water temperature cannot reach the nominal opening temperature of the thermostat.)
27	U0073	00	Can bus 1 Bus OFF fault
28	U01B0	00	Lost communication with EBS module
29	U0122	88	Lost communication with ESP module
30	U0146	00	Lost communication with GW module
31	U0101	00	Loss of communication with TCM module
32	U3502	00	Can module input voltage too high

33	U3501	00	Can module input voltage too low
34	U0104	88	Lost communication with cruise module node 1
35	U0104	87	Lost communication with cruise module node 2
36	U0128	00	Lost communication with EPB module
37	U0122	87	Lost communication with ESP module node 2
38	U0122	86	Lost communication with ESP module node 3
39	U0146	88	Lost communication with GW module node 1
40	U0146	87	Lost communication with GW module node 2
41	U0151	00	Loss of communication with SRS module
42	P1510	00	Knock sensor signal evaluation diagnosis
43	P1270	00	Rail pressure signal of rail pressure sensor of high-pressure oil passage exceeds the upper limit
44	P0191	28	The characteristic curve of the rail pressure sensor of the high-pressure oil passage is negatively offset.
45	P0191	29	Oil rail pressure sensor characteristic curve of high-pressure oil passage is forward offset
46	P0194	00	High-pressure oil passage oil rail pressure sensor signal sticking fault
47	P0193	00	High pressure oil rail pressure sensor circuit voltage too high
48	P0192	00	High pressure oil rail pressure sensor circuit voltage too low
49	P0190	00	The high-pressure oil passage rail pressure sensor voltage signal is unreasonable.
50	P0451	28	Fuel tank pressure sensor signal offset fault
51	P0453	00	Tank pressure sensor circuit voltage too high
52	P0452	00	Tank pressure sensor circuit voltage too low
53	P1282	00	Tank pressure sensor signal out of range(Forward)
54	P1283	00	Tank pressure sensor signal out of range(Negative)
55	P0451	2A	Fuel tank pressure sensor signal sticking rationality fault
56	P0451	25	Tank pressure sensor signal oscillation fault
57	P0133	00	Upstream oxygen sensor aging
58	P1430	00	Battery type change fault
59	P1431	00	EBS or battery fault
60	P1432	00	EBS communication load rate is too high
61	P050B	00	Ignition angle efficiency monitoring during catalyst heating(Idle speed)
62	P06DC	00	Secondary oil pump control circuit voltage too high
63	P06DB	00	Secondary oil pump control circuit voltage too low
64	P06DA	00	Secondary oil pump control open circuit
65	P1388	24	The cold start calibration of ambient temperature sensor is unreasonable.(Positive deviation)
66	P1388	23	The cold start calibration of ambient temperature sensor is unreasonable.(Negative deviation)
67	P0070	00	Ambient temperature sensor CAN communication loss
68	P0341	00	Intake camshaft sensor signal unreasonable fault(Bank1)
69	P0016	76	Crankshaft - Intake camshaft Initial Installation

			Position Unreasonable Fault(Bank1)
70	P0343	00	Intake camshaft sensor signal short circuit to power supply(Bank1)
71	P0342	00	Intake camshaft sensor signal short circuit to ground(Bank1)
72	P0016	78	Crankshaft-intake camshaft relative position deviation is too large fault(Bank1)
73	P0366	00	Unreasonable fault of exhaust camshaft sensor signal(Bank1)
74	P0017	76	Improper initial installation position of crankshaft-exhaust camshaft(Bank1)
75	P0368	00	Exhaust camshaft sensor signal short circuit to power supply(Bank1)
76	P0367	00	Exhaust camshaft sensor signal short circuit to ground(Bank1)
77	P0017	78	Crankshaft-exhaust camshaft relative position deviation is too large fault(Bank1)
78	P0336	64	Crankshaft sensor pulse width signal is unreasonable
79	P0339	00	Unreasonable fault of speed sensor signal
80	P2617	00	Speed sensor signal loss fault
81	P2177	00	Air-fuel ratio closed-loop control self-learning value exceeds the upper limit(Middle load area)
82	P2178	00	Air-fuel ratio closed loop control self-learning value exceeds the lower limit(Middle load area)
83	P0460	00	Oil level sensor original signal out of range
84	U0676	00	Oil level sensor signal loss/failure/calibration error
85	P25B0	00	Oil level sensor signal sticking fault
86	P2097	00	Closed loop correction value based on downstream oxygen sensor exceeds the upper limit - too high
87	P2096	00	Closed loop correction value based on downstream oxygen sensor exceeds the lower limit - too lean
88	P0480	00	Cooling fan 1 control circuit open
89	P0481	00	Cooling fan 2 control circuit open
90	P0482	00	Cooling fan 3 control circuit open
91	P0634	00	Cooling fan 1 drive chip overheating
92	P0634	4A	Cooling fan 3 drive chip overheating
93	P0692	00	Cooling fan 1 control circuit voltage too high
94	P0694	00	Cooling fan 2 control circuit voltage too high
95	P0696	00	Cooling fan 3 control circuit voltage too high
96	P0691	00	Cooling fan 1 control circuit voltage too low
97	P0693	00	Cooling fan 2 control circuit voltage too low
98	P0695	00	Cooling fan 3 control circuit voltage too low
99	P1440	00	Intelligent generator circuit fault
100	P1441	00	Mechanical fault of intelligent generator
101	P1442	00	Intelligent alternator communication fault
102	P0011	00	Improper operation of intake camshaft locked position
103	P0014	00	Unreasonable operation fault of exhaust camshaft lock position
104	P0010	00	Intake VVT control circuit open
105	P0013	00	Exhaust VVT control circuit open

**3.1.2 -5****On-board Diagnosis****3.1.2 -5**

106	P2089	00	Intake VVT control circuit voltage too high
107	P2091	00	Exhaust VVT control circuit voltage too high
108	P2088	00	Intake VVT control circuit voltage too low
109	P2090	00	Exhaust VVT control circuit voltage too low
110	P000A	00	Intake VVT operation fault(Slow)
111	P000B	00	Exhaust VVT operation fault(Slow)
112	P003C	00	Intake VVT operation fault(Stuck)
113	P005A	00	Exhaust VVT operation fault(Stuck)
114	P053F	22	High pressure oil circuit pressure too high fault during catalyst heating
115	P053F	21	Low pressure of high-pressure oil circuit during catalyst heating
116	P0089	85	High pressure oil supply oil pressure PID control deviation is too large
117	P0089	84	High pressure oil supply oil pressure PID control deviation is too small
118	P0088	00	High pressure oil rail pressure is too high
119	P0087	00	Low pressure of high-pressure oil rail
120	P0138	00	Downstream oxygen sensor signal wire is short to power supply
121	P0137	00	Downstream oxygen sensor signal wire is short to ground.
122	P2232	00	Downstream oxygen sensor signal wire coupled to heating wire
123	P0136	00	Downstream oxygen sensor signal open circuit
124	P0054	00	Downstream oxygen sensor heating internal resistance is unreasonable
125	P0038	00	Downstream oxygen sensor heating control circuit voltage too high
126	P0037	00	Downstream oxygen sensor heating control circuit voltage too low
127	P0036	00	Downstream oxygen sensor heating control circuit open
128	P013A	00	Downstream oxygen sensor reaction is slow from rich to lean
129	P2271	00	Downstream oxygen sensor aging - signal continuously too rich
130	P2270	00	Downstream oxygen sensor aging - signal continuously lean
131	P02CD	00	Cylinder No.1 CVO self-learning adjustment up to upper limit
132	P02D1	00	Cylinder No.3 CVO self-learning adjustment up to upper limit
133	P02D3	00	Cylinder No.4 CVO self-learning adjustment up to upper limit
134	P02CF	00	Cylinder No.2 CVO self-learning adjustment up to upper limit
135	P062B	9A	Similar working condition path of self-learning adjustment overrun fault
136	P02CC	00	Cylinder No.1 CVO self-learning adjustment reaches the lower limit
137	P02D0	00	Cylinder No.3 CVO self-learning adjustment reaches the lower limit



**3.1.2 -6****On-board Diagnosis****3.1.2 -6**

138	P02D2	00	Cylinder No.4 CVO self-learning adjustment reaches the lower limit
139	P02CE	00	Cylinder No.2 CVO self-learning adjustment reaches the lower limit
140	P062B	64	Circuit signal unreasonable fault similar working condition path
141	P062B	96	ECU control unit fault(All cylinders have CVO fault)
142	P1261	00	Cylinder No.1 CVO circuit signal unreasonable fault
143	P1263	00	Cylinder No.3 CVO circuit signal unreasonable fault
144	P1264	00	Cylinder No.4 CVO circuit signal unreasonable fault
145	P1262	00	Cylinder No.2 CVO circuit signal unreasonable fault
146	P0351	00	Cylinder No.1 ignition coil control circuit open
147	P0353	00	Cylinder No.3 ignition coil control circuit open
148	P0354	00	Cylinder 4 ignition coil control circuit open
149	P0352	00	Cylinder No.2 ignition coil control circuit open
150	P2301	00	Cylinder No.1 ignition coil control circuit voltage too high
151	P2307	00	Triplex ignition coil control circuit voltage too high
152	P2310	00	Cylinder No.4 ignition coil control circuit voltage too high
153	P2304	00	Cylinder No.2 ignition coil control circuit voltage too high
154	P2300	00	Cylinder No.1 ignition coil control circuit voltage too low
155	P2306	00	Triplex ignition coil control circuit voltage too low
156	P2309	00	Cylinder No.4 ignition coil control circuit voltage too low
157	P2303	00	Cylinder No.2 ignition coil control circuit voltage too low
158	P1290	00	The inspection value of particle trap differential pressure sensor after running Offset is unreasonable.
159	P12E0	00	The inspection value of particle trap differential pressure sensor after running Offset is unreasonable.(Downstream)
160	P05EC	00	Multiple injection monitoring fault during catalyst heating
161	P0201	00	Cylinder No.1 fuel injector control circuit open
162	P0203	00	Cylinder No.3 fuel injector control circuit open
163	P0204	00	Cylinder No.4 fuel injector control circuit open circuit
164	P0202	00	Cylinder No.2 fuel injector control circuit open
165	P2148	00	I. High-side control circuit voltage of cylinder 4 injector is too high or too low, or low-side control circuit voltage of cylinder 4 injector is too high or too low
166	P2151	00	II. High-side control circuit voltage of cylinder No.3 fuel injector is too high or too low, or low-side control circuit voltage of cylinder No.2 fuel injector is too low or too high
167	P0262	00	Cylinder No.1 fuel injector low side control circuit voltage too high or too low
168	P0268	00	Triplex injector low-side control circuit voltage too high or too low

**3.1.2 -7****On-board Diagnosis****3.1.2 -7**

169	P0271	00	Cylinder No.4 fuel injector low side control circuit voltage too high or too low
170	P0265	00	Cylinder No.2 fuel injector low side control circuit voltage too high or too low
171	P02EE	00	Cylinder No.1 fuel injector high and low side control circuits are mutually shorted
172	P02F0	00	High and low side control circuits of cylinder No.3 fuel injector are mutually shorted.
173	P02F1	00	Cylinder No.4 fuel injector high and low side control circuits are mutually shorted.
174	P02EF	00	Cylinder No.2 fuel injector high and low side control circuits are mutually shorted
175	P00CE	24	Intake air temperature sensor 1 cold start calibration is unreasonable(Positive deviation)
176	P00CE	23	Intake air temperature sensor 1 cold start calibration is unreasonable(Negative deviation)
177	P0114	00	Intake air temperature sensor 1 circuit voltage is unreasonable
178	P0113	00	Intake air temperature sensor 1 circuit voltage too high
179	P0112	00	Intake Air Temperature Sensor 1 Circuit Low
180	P0111	26	Intake air temperature sensor 1 signal is unreasonable(Sticky)
181	P1380	24	Intake air temperature sensor 2 cold start calibration is unreasonable(Positive deviation)
182	P1380	23	Intake air temperature sensor 2 cold start calibration is unreasonable(Negative deviation)
183	P0099	00	Intake air temperature sensor 2 circuit voltage is unreasonable
184	P0098	00	Intake air temperature sensor 2 circuit voltage too high
185	P0097	00	Intake Air Temperature Sensor 2 Circuit Low
186	P0096	26	Intake air temperature sensor 2 signal is unreasonable(Sticky)
187	P0629	00	Fuel pump relay control circuit voltage too high
188	P0628	00	Fuel pump relay control circuit voltage too low
189	P0627	00	Fuel pump relay control circuit open
190	P0326	00	Knock sensor signal circuit voltage too high
191	P0325	00	Knock sensor signal circuit voltage too low
192	P0328	00	Short circuit diagnosis of knock sensor A terminal to power supply
193	P0327	00	Short circuit diagnosis of knock sensor A end to ground
194	P0328	15	Short circuit diagnosis of knock sensor terminal B to power supply
195	P0327	14	Short circuit diagnosis of knock sensor B end to ground
196	P0234	00	Turbocharger boost pressure display too high
197	P0299	00	Turbocharger boost pressure display too low
198	P1428	00	LIN1 bus message receiving time exceeds limit
199	P1415	00	LIN bus response timeout supporting communication between EMS and smart generator
200	P1417	00	Lin bus checksum error supporting communication

			between EMS and smart generator
201	P1421	00	Lin hardware register response timeout
202	P0507	00	Engine idle speed is high
203	P0506	00	Engine idle speed is low
204	P0505	00	Engine idle speed fluctuation out of range
205	P050A	22	Engine idle speed is too high during catalyst heating
206	P050A	21	Engine idle speed too low during catalyst heating
207	P0300	00	Engine random or multi-cylinder misfire fault
208	P0301	00	Physical cylinder 1 misfire fault detected
209	P0303	00	Physical triplex misfire fault detected
210	P0304	00	Physical cylinder 4 misfire fault detected
211	P0302	00	Physical cylinder No.2 misfire fault detected
212	P0363	00	Engine misfire triggering fuel cut
213	P0700	00	Transmission control fault request illuminates MIL lamp
214	P15A0	00	CPU0: MPU fault(Register, DSPR, PSPR)
215	P15A1	00	CPU0: DCACHE/DSPR ECC Uncorrectable fault
216	P15A2	00	CPU0: DCACHE/DSPR address fault
217	P15A3	00	CPU0:DCACHE TAG SRAM ECC Uncorrectable fault
218	P15A4	00	CPU0:DCACHE TAG SRAM address fault
219	P15A5	00	CPU0:PCACHE TAGRAM ECC Uncorrectable fault
220	P15A6	00	CPU0:PCACHE TAGRAM address fault
221	P15A7	00	CPU0: PCACHE/PSPR ECC Uncorrectable fault
222	P15A8	00	CPU0:PCACHE/PSPR address fault
223	P15A9	00	CPU1:Lockstep comparator fault
224	P15AA	00	CPU1:MPU fault(Register, DSPR, PSPR)
225	P15AB	00	CPU1:DCACHE/DSPR ECC Uncorrectable fault
226	P15AC	00	CPU1:DCACHE/DSPR address fault
227	P15AD	00	CPU1:DCACHE TAGRAM ECC Uncorrectable fault
228	P15AE	00	CPU1:DCACHE TAGRAM address fault
229	P15AF	00	CPU1:PCACHE TAGRAM ECC Uncorrectable fault
230	P15B0	00	CPU1:PCACHE TAGRAM address fault
231	P15B1	00	CPU1:PCACHE/PSPR ECC Uncorrectable fault
232	P15B2	00	CPU1:PCACHE/PSPR address fault
233	P15B3	00	LMU:SRAM ECC monitoring fault
234	P15B4	00	LMU:SRAM ECC Uncorrectable fault
235	P15B5	00	LMU:SRAM address fault
236	P15B6	00	SMU: recovery Timer 0 timeout fault
237	P15B7	00	SMU: recovery Timer 1 timeout fault
238	P15B8	00	PMU:PFLASH ECC Non-correctable multi-bit fault
239	P15B9	00	PMU:PFLASH address fault
240	P15BA	00	PMU:PFLASH ECC monitoring fault(Cover all ECC modules)
241	P15BB	00	PMU:PFLASH EDC comparator fault(Cover all PFLASH instances)
242	P15BC	00	SCU/CGU: system PLL OSC_WDT: input clock overrun fault

243	P15BD	00	SCU/CGU: system PLL VCO clock event loss fault
244	P15BE	00	SCU/EVR: EVR 1.3 V digital undervoltage fault
245	P15BF	00	SCU/EVR: EVR 3.3 V overvoltage fault
246	P15C0	00	SCU/EVR: external power supply overvoltage fault
247	P15C1	00	SCU/WDTS: Safety watchdog timeout fault
248	P15C2	00	SCU/WDTCPU0: watchdog CPU0 timeout fault
249	P15C3	00	SCU/WDTCPU1: Watchdog CPU 1 timeout fault
250	P15C4	00	SCU/CGU: PLL_ERAY VCO clock event loss fault
251	P15C5	00	SCU/WDTCPU2: Watchdog CPU 2 timeout fault
252	P15C6	00	SCU/DTS: temperature sensor overflow fault
253	P15C7	00	Fault detected by Registers: register monitoring
254	P15C8	00	SCU/LSCU: SCU Configuration Fault: Monitor Dual Rail Properties from lockstep LSCU Alarm
255	P15C9	00	SCU/CGU: clock monitoring: STM out of frequency range fault
256	P15CA	00	SCU/CGU: clock monitoring: PLL_ERAY out of frequency range fault
257	P15CB	00	SCU/CGU: clock monitoring: PLL out of frequency range fault
258	P15CC	00	SCU/CGU: clock monitoring: SRI out of frequency range fault
259	P15CD	00	SCU/CGU: clock monitoring: SPB out of frequency range fault
260	P15CE	00	SCU/CGU: clock monitoring: GTM out of frequency range fault
261	P15CF	00	SCU/CGU: clock monitoring: ADC out of frequency range fault
262	P15D0	00	GTM: SRAMs Uncorrectable fault
263	P15D1	00	FLEXRAY:SRAM address fault
264	P15D2	00	Misc SRAMs:SRAM ECC Uncorrectable fault
265	P15D3	00	Misc SRAMs:SRAM address fault
266	P15D4	00	GTM: SRAMs address fault
267	P15D5	00	CAN: SRAM Uncorrectable fault
268	P15D6	00	CAN: SRAM address fault
269	P15D7	00	FLEXRAY:SRAM ECC Uncorrectable fault
270	P15D8	00	CPU2:MPU fault(Register, DSPR, PSPR)
271	P15D9	00	CPU2: DCACHE/DSPR ECC Uncorrectable fault
272	P15DA	00	CPU2: DCACHE/DSPR address fault
273	P15DB	00	CPU2: DCACHE TAG SRAM ECC Uncorrectable fault
274	P15DC	00	CPU2:DCACHE TAG SRAM address fault
275	P15DD	00	CPU2: 121 PCACHE TAGRAM ECC Uncorrectable fault
276	P15DE	00	CPU2:PCACHE TAGRAM address fault
277	P15DF	00	CPU2: PCACHE/PSPR ECC Uncorrectable fault
278	P15E0	00	CPU2: PCACHE/PSPR address fault
279	P0685	00	Main relay open circuit fault
280	P0687	00	Short circuit fault of main relay to power supply
281	P0686	00	Main relay short circuit to ground fault

**3.1.2 -10****On-board Diagnosis****3.1.2 -10**

282	P0251	00	Flow control valve high or low control circuit open
283	P0254	00	Flow control valve high-side control circuit voltage too high or too low
284	P0090	00	Flow control valve high-side control circuit high-low side short circuit
285	P0259	00	Flow control valve low side control circuit voltage too high or too low
286	P1530	00	AD converter zero test monitoring fault
287	P1531	00	AD converter given voltage test monitoring fault
288	P1571	00	Close drive level check fault or communication fault in path check
289	P060D	00	Second layer accelerator pedal signal rationality fault
290	P1520	00	Load prediction monitoring fault
291	P1521	00	Oil circuit monitoring fault in fuel cut-off mode
292	P1522	00	Fuel circuit monitoring fault in fuel supply mode
293	P1539	00	Synchronization process rationality check(Based on speed and synchronous count)
294	P1537	00	Load comparison monitoring fault
295	P1535	00	Mixture monitoring fault
296	P1536	00	Working mode monitoring fault
297	P061C	00	2nd floor engine speed monitoring fault
298	P1538	00	Ignition angle signal, harness or ECU fault
299	P1527	00	First floor safety fuel cut-off monitoring fault
300	P1528	00	2nd floor safety fuel cut-off monitoring fault
301	P1529	00	Starter control monitoring fault
302	P061A	00	2nd floor torque monitoring fault(Torque comparison fault)
303	P1572	00	Under normal voltage conditions, ABE is activated.
304	P1573	00	Monitoring error response fault
305	P1574	00	Errorpin is activated and monitoring communication is normal
306	P1575	00	Overvoltage causes DVE drive shutdown fault
307	P2187	00	Air-fuel ratio closed-loop control self-learning value exceeds the upper limit(Idle speed)
308	P2188	00	Air-fuel ratio closed loop control self-learning value exceeds the lower limit(Idle speed)
309	P2227	22	Ambient pressure sensor pressure unreasonable high fault
310	P2227	21	Ambient pressure sensor pressure unreasonable low fault
311	P2227	85	Ambient pressure sensor signal too high during start
312	P2227	84	Ambient pressure sensor signal is too low during start
313	P1202	00	Ambient pressure sensor pressure overrange high fault
314	P1203	00	Ambient pressure sensor pressure overrange low fault
315	P2229	00	Short circuit fault of ambient pressure sensor to power supply
316	P2228	00	Ambient pressure sensor short circuit to ground fault
317	P2227	29	Ambient pressure sensor signal fault

318	P226D	00	Particulate trap removed/pressure sensor/line malfunction
319	P0108	00	Intake manifold pressure sensor short circuit to power supply fault
320	P0107	00	Intake manifold pressure sensor short circuit to ground fault
321	P2195	00	LSU oxygen sensor characteristic offset (lean side) fault
322	P2196	00	LSU oxygen sensor characteristic offset (rich side) fault
323	P0523	00	High oil pressure sensor circuit voltage/duty cycle
324	P0522	00	Oil pressure sensor circuit voltage/duty cycle low
325	P1210	00	Low duty cycle of oil pressure sensor circuit
326	P1291	00	Particle trap differential pressure sensor GPF improper dynamic response/or abnormal pipeline
327	P12E1	00	Particle trap differential pressure sensor GPF improper dynamic response/or abnormal pipeline(Downstream)
328	P2455	00	Particulate trap differential pressure sensor circuit voltage too high(Upstream)
329	P2461	00	Particulate trap differential pressure sensor circuit voltage too high(Downstream)
330	P2454	00	Particulate trap differential pressure sensor circuit voltage too low(Upstream)
331	P2460	00	Particulate trap differential pressure sensor circuit voltage too low(Downstream)
332	U0601	00	Particle trap differential pressure sensor Sent communication fault(Upstream)
333	U0602	00	Particle trap differential pressure sensor Sent communication fault(Downstream)
334	U0601	41	Improper inspection of differential pressure sensor data of particle trap(Upstream)
335	U0602	41	Improper inspection of differential pressure sensor data of particle trap(Downstream)
336	P1293	00	Upstream pressure sensor channel 1 digital signal of particle trap is unreasonable.(SENT signal too high or too low)
337	P12E3	00	The downstream pressure sensor channel 1 digital signal of particle trap is unreasonable.(SENT signal too high or too low)
338	P12A2	00	Particle trap differential pressure sensor line connection error
339	P12A3	00	Particle trap differential pressure sensor rear pipe connecting line abnormal/completely blocked/sensor sticky
340	P1200	00	Intake pressure sensor pressure overrange high fault
341	P1201	00	Intake pressure sensor pressure overrange low fault
342	P00C7	21	Intake pressure sensor signal is too low during start
343	P00C7	22	Intake pressure sensor signal is too high during start
344	P0106	22	Intake pressure sensor pressure is far higher than model pressure unreasonable fault
345	P0106	21	Intake pressure sensor pressure is far lower than model pressure unreasonable fault

346	P0106	2A	Intake pressure sensor signal value abnormal without fluctuation fault
347	P0468	00	High load desorption line pressure sensor circuit voltage too high
348	P0467	00	High load desorption line pressure sensor circuit voltage too low
349	P1285	00	High load desorption line pressure sensor signal exceeds upper threshold
350	P1286	00	High load desorption line pressure sensor signal exceeds lower threshold
351	P0238	00	Boost pressure sensor short circuit to power supply
352	P0237	00	Boost pressure sensor short circuit to ground
353	P1204	00	High overrange fault of boost pressure
354	P1205	00	Supercharging pressure out of range low fault
355	P0236	22	Unreasonably high boost pressure fault
356	P0236	21	Unreasonable boost pressure low fault
357	P2123	00	Electronic accelerator pedal position sensor 1 signal voltage too high
358	P2128	00	Electronic accelerator pedal position sensor 2 signal voltage too high
359	P2122	00	Electronic accelerator pedal position sensor 1 signal voltage too low
360	P2127	00	Electronic accelerator pedal position sensor 2 signal voltage too low
361	P0641	00	5V power supply module 1 has fault
362	P0651	00	Chip 5V supply voltage 2 fault
363	P0697	00	5V power supply module 3 has fault
364	P14AC	00	The starter is damaged or the starter supply circuit is interrupted.
365	P14AD	00	Engine is blocked or the starter and flywheel are not engaged.
366	P14AE	00	Short circuit fault between starter feedback voltage signal wire KL50r and power supply or R1 relay sticking
367	P14AF	00	Short circuit fault between starter feedback voltage signal wire KL50r and ground
368	P00C6	00	High voltage starting does not operate normally
369	P26F0	00	Starter relay Crank relay cannot disengage fault
370	P26F2	00	Drive chain status PT State Relay cannot disengage fault
371	P26F1	00	Starter Relay Crank relay or Drive Chain Status Relay PT State Relay Does Not Engage
372	P2261	00	Mechanical fault of turbocharger relief valve
373	P0615	00	Starter relay control circuit fault - control terminal A
374	P0634	41	Starter drive chip 1 overheating
375	P0617	00	Starter relay control circuit voltage too high
376	P0616	00	Starter relay control circuit voltage too low
377	P2138	00	Electronic accelerator pedal position sensor signal is unreasonable
378	P0442	00	Evaporation system 1.0 mm leakage
379	P0455	00	Evaporation system 2.2 mm leaks or tank cap is not tightened

380	P04F0	00	High load desorption pipeline fault - canister valve fault
381	P0496	00	Canister solenoid valve stuck normally open
382	P0497	00	Canister solenoid valve stuck normally closed
383	P0459	00	Canister control valve control circuit voltage too high
384	P0458	00	Canister control valve control circuit voltage too low
385	P0444	00	Canister control valve control circuit open
386	P20E2	24	Improper cold start calibration of upstream temperature sensor of particle trap(Positive deviation)
387	P20E2	23	Improper cold start calibration of upstream temperature sensor of particle trap(Negative deviation)
388	P2080	62	The signal model and actual deviation of upstream temperature sensor of particle trap are too large.
389	P0546	00	Particle trap upstream temperature sensor circuit voltage too high
390	P0545	00	Particle trap upstream temperature sensor circuit voltage too low
391	P2080	2A	Particle trap upstream temperature sensor signal sticky fault
392	P0420	00	Three-way catalytic converter oxygen storage capacity aging
393	P1551	00	Electronic throttle lower limit position initialization self-learning fault
394	P1550	00	Electronic throttle valve self-learning condition is not satisfied
395	P1556	00	Throttle mechanical bottom dead center self-learning maximum fault again
396	P1557	00	Throttle mechanical bottom dead center self-learning minimum fault again
397	P1561	00	DVE position control deviation fault
398	P1560	00	Throttle body PID adjustment out of range
399	P1558	00	Throttle limp position and initial self-learning deviation out of range
400	P1559	00	Throttle limp position above upper limit
401	P155A	00	Throttle limp position and previous self-learning deviation exceed limit
402	P155B	00	Throttle limp position below lower limit
403	P2100	00	Electronic throttle drive stage fault(Open circuit)
404	P2118	00	Electronic throttle drive stage fault(Overheating or overcurrent)
405	P1554	00	Return spring check maximum fault
406	P1555	00	Return spring check minimum fault
407	P0123	00	Electronic Throttle Position Sensor 1 Signal Circuit High Voltage
408	P0121	00	Electronic throttle position sensor 1 signal is unreasonable
409	P0223	00	Electronic Throttle Position Sensor 2 Signal Circuit High Voltage
410	P0222	00	Electronic Throttle Position Sensor 2 Signal Circuit Low
411	P0221	00	Electronic throttle position sensor 2 signal is unreasonable



412	P2103	00	Electronic throttle drive stage fault(Short circuit)
413	P2106	00	Electronic throttle drive stage fault(Unreasonable)
414	P0122	00	Electronic Throttle Position Sensor 1 Signal Circuit Low
415	P0244	77	Turbocharger electronic waste valve target position and actual position deviation out of range fault
416	P0244	37	Turbocharger electronic waste valve duty ratio overrange fault
417	P0243	00	Boost Exhaust Control Circuit Open
418	P003A	22	Turbocharger electronic wastegate primary zero position self-learning over upper limit fault
419	P003A	21	Turbocharger electronic wastegate primary zero position self-learning out of lower limit fault
420	P003A	72	Turbocharger electronic wastegate zero position self-learning over upper limit fault
421	P003A	73	Turbocharger Electronic Waste Valve Zero Position Self-learning Out of Lower Limit Fault
422	P2565	00	Turbocharger electronic wastegate position sensor voltage too high fault
423	P2564	00	Turbocharger electronic wastegate position sensor low voltage fault
424	P0246	00	Boost Exhaust Control Circuit High or Low
425	P1703	00	Pressurized exhaust control circuit communication fault
426	P064D	00	LSU integrated chip register write fault
427	P0053	00	Upstream oxygen sensor heating circuit fault
428	P0032	00	Upstream oxygen sensor heating control circuit voltage too high
429	P0031	00	Upstream oxygen sensor heating control circuit voltage too low
430	P0030	00	Upstream oxygen sensor heating control circuit open
431	P2251	00	Open circuit of upstream oxygen sensor IPE
432	P2243	00	Upstream oxygen sensor RE wire open circuit
433	P0132	00	Upstream oxygen sensor signal circuit voltage too high(APE IPE RE wire is short to power supply)
434	P0131	00	Upstream oxygen sensor signal circuit voltage too low(APE IPE RE wire is short to ground)
435	P064D	13	LSU integrated chip SPI communication fault
436	P2414	00	Upstream oxygen sensor output voltage is unreasonable
437	P12C2	00	Crankcase Vent Line Diagnostic Circuit High
438	P12C3	00	Crankcase Vent Line Diagnostic Circuit Low
439	P0035	00	Boost relief valve control circuit voltage too high
440	P0034	00	Boost relief valve control circuit voltage too low
441	P0033	00	Boost relief valve control circuit open
442	P2237	13	LSU oxygen sensor APE wire open circuit
443	P0630	00	VIN code is not written or incompatible
444	P1212	00	Vehicle speed sensor performance fault(Speed exceeding maximum range)
445	P0500	00	Vehicle speed sensor input signal fault
446	P0501	65	Vehicle speed sensor performance fault(Vehicle

			speed is too low when sliding fuel cut)
447	P0501	66	Vehicle speed unreasonable fault - vehicle speed too low fault under heavy engine load
448	P1615	00	Vehicle immobilizer configuration does not match EMS, i.e. vehicle is immobilizer, but EMS is not immobilizer
449	P0513	00	The PEPS approval reply is incorrect, and it is prohibited to start the engine.
450	P1613	00	Communication error when sending approval result
451	P0633	00	EMS does not learn SK
452	P1612	00	Invalid value for SupplierID
453	P1610	00	EMS does not receive a valid PEPS reply, and the engine is prohibited from starting.
454	P1614	00	PEPS approval reply checksum error
455	P1304	00	Electronic water pump additional fault
456	P1301	00	Electronic water pump dry running fault
457	P261D	00	Turbo cooling electronic water pump control circuit voltage too high
458	P261C	00	Turbine cooling electronic water pump control circuit voltage too low/rationality fault
459	P261A	00	Turbine cooling electronic water pump control circuit open circuit
460	P1305	00	Electronic water pump temperature too high fault
461	P1308	00	Electronic water pump blocking fault
462	P2610	00	Unreasonable shutdown timing fault
463	P0686	9E	ECM/PCM main relay sticking fault or short circuit to ground fault
464	P06B8	42	Error reading NVM Block
465	P06B8	43	Error writing NVM Block

## 3.1.3 Mechanical system

### Specifications

#### Material specification

Name	Specifications	Capacity
Sealant	Loctite 5900(All joint surfaces of oil pan and crankcase and lower end of rear end cover, joint surfaces of rear end cover and crankcase, joint surfaces of front end of crankcase and cylinder head and front cover assembly, cylinder gasket protrudes from front side and reverse side with glue, front cover assembly and cylinder body and cylinder head joint T-shaped area, front cover assembly and cylinder body and oil pan joint T-shaped area, cylinder head cover and cylinder head and front cover assembly T-shaped area, cylinder head cover and 10# camshaft cover and cylinder head joint T-shaped area, 10# camshaft cover and cylinder head joint area, crankcase and crankshaft rear end cover and oil pan joint T-shaped area)	-
High temperature anti-bite compound	Tianshan 1767(Supercharger and three-way catalytic converter connecting stud)	-
Thread seal lock anaerobic adhesive	Loctite 243(Cylinder block screw plug, plug thread, bolt thread surface)	-
Thread seal lock anaerobic adhesive	Loctite 263(Cylinder head screw plug, plug thread surface)	-
Cylinder retaining anaerobic adhesive	Loctite 962T(Cylinder block, cylinder head bowl plug)	-
Oil	SN/GF-5 5W-30	4.0L

#### General specifications

Name	Specifications
Engine type	Direct injection boost, horizontal, DVVT, in-line four-cylinder, four-stroke, water cooling, double overhead camshaft, four-valve
Fuel supply mode	In-cylinder direct injection
Intake mode	Turbocharging
Timing drive mode	Timing chain
Cylinder diameter	86mm
Piston stroke	86mm
Displacement	1998mL
Maximum power(General)	171kW/5500 rpm
Maximum torque(General)	390Nm/1900 ~ 3300 rpm
Idle speed	700 ±50 rpm(Bench)

Ignition sequence

1-3-4 - 2

**Torque specification****Torque specification of closing bolt**

Serial number	Name	Assembly position	Tightening method
1	Main bearing cap bolt	Crankcase	Angle method: $(40 \pm 2)$ N.m+ $(90 \pm 2)$ ? Monitoring: (70-130) N.m
2	Connecting rod bolt	Connecting rod cap	Angle method: $(30 \pm 2)$ N.m+ $(90 \pm 2)$ ? Monitoring: (50-90) N.m
3	Cylinder head connecting bolt	Cylinder head	Angle method: $(30 \pm 2)$ N.m+ $(180 \pm 2)$ ? Monitoring: (55-110) N.m
4	Crankshaft pulley combination bolt	Crankshaft	Angle method: $(120 \pm 2)$ N.m+ $(120 \pm 2)$ ? Monitoring: (238-402) N.m
5	Drive bolt	Crankshaft	Angle method: $(40 \pm 2)$ N.m+ $(30 \pm 2)$ ? Monitoring: (60-110) N.m

## General bolt torque specification

Serial number	Chinese name	Assembly position	Nm	lb-ft	lb-in
1	Supercharger oil inlet pipe hollow bolt	Crankcase	34±2	25	-
2	Supercharger connecting stud	Supercharger and cylinder head	15±1	11	-
3	Supercharger connecting nut	Supercharger and cylinder head	40±2	30	-
4	Supercharger connecting stud	Supercharger and three-way catalytic converter	6±1	-	53
5	Supercharger connecting nut	Supercharger and three-way catalytic converter	25	18	-
6	Connecting bolt between crankshaft and balance shaft	Balance shaft	45	33	-
7	Signal plate screw	Eighth sector plate of crankshaft	15±1	11	-
8	Process hole is blocked	Crankshaft rear end cover	40±2	30	-
9	Cylinder head cover short bolt	Cylinder head cover	13±1	10	-
10	Crankcase R3/8 screw plug	Crankcase	40±2	30	-
11	Crankcase R1/8 screw plug	Cylinder head	12±2	9	-
12	Cylinder head channel screw plug	Cylinder head	75±5	55	-
13	Screw plug at cylinder head IEM	Cylinder head	56±3	41	-
14	Camshaft bearing cover bolt	Camshaft bearing cover	12±1	9	-
15	Bolt	Fuel manifold	32±2	24	-
16	Bolt	Water pump	32±2	24	-
17	Bolt	Front gear train tensioner	65±3	48	-
18	Bolt	Front gear train idler gear assembly	65±3	48	-
19	Bolt	No. 1 engine hook	65±3	48	-
20	Bolt	No. 2 engine hook	65±3	48	-
21	Tapping screw	Boost pressure temperature sensor assembly	8±0.5	-	71
22	Bolt	Starter motor	50±3	37	-

## Other general bolts as per Table A1 N.m

Thread size	8.8 Grade			Class 10.9		
	Nm	lb-ft	lb-in	Nm	lb-ft	lb-in
M6	10±1	-	89	13±1	10	-

3.1.3 -4

Mechanical system

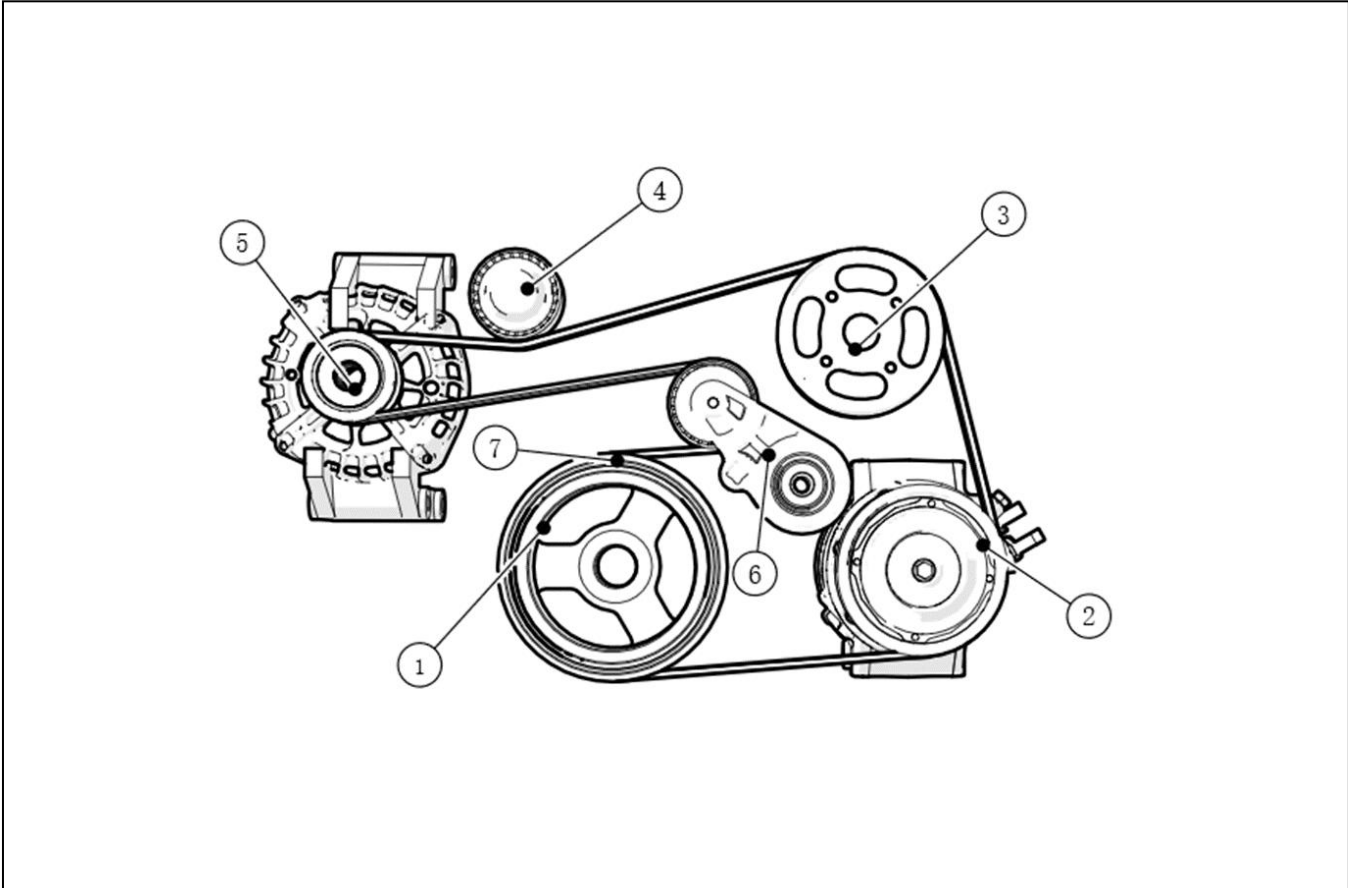
3.1.3 -4

M8	23±2	17	-	32±2	24	-
M10	50±3	37	-	65±3	48	-
M12	80±5	59	-	110±5	81	-

Description and operation

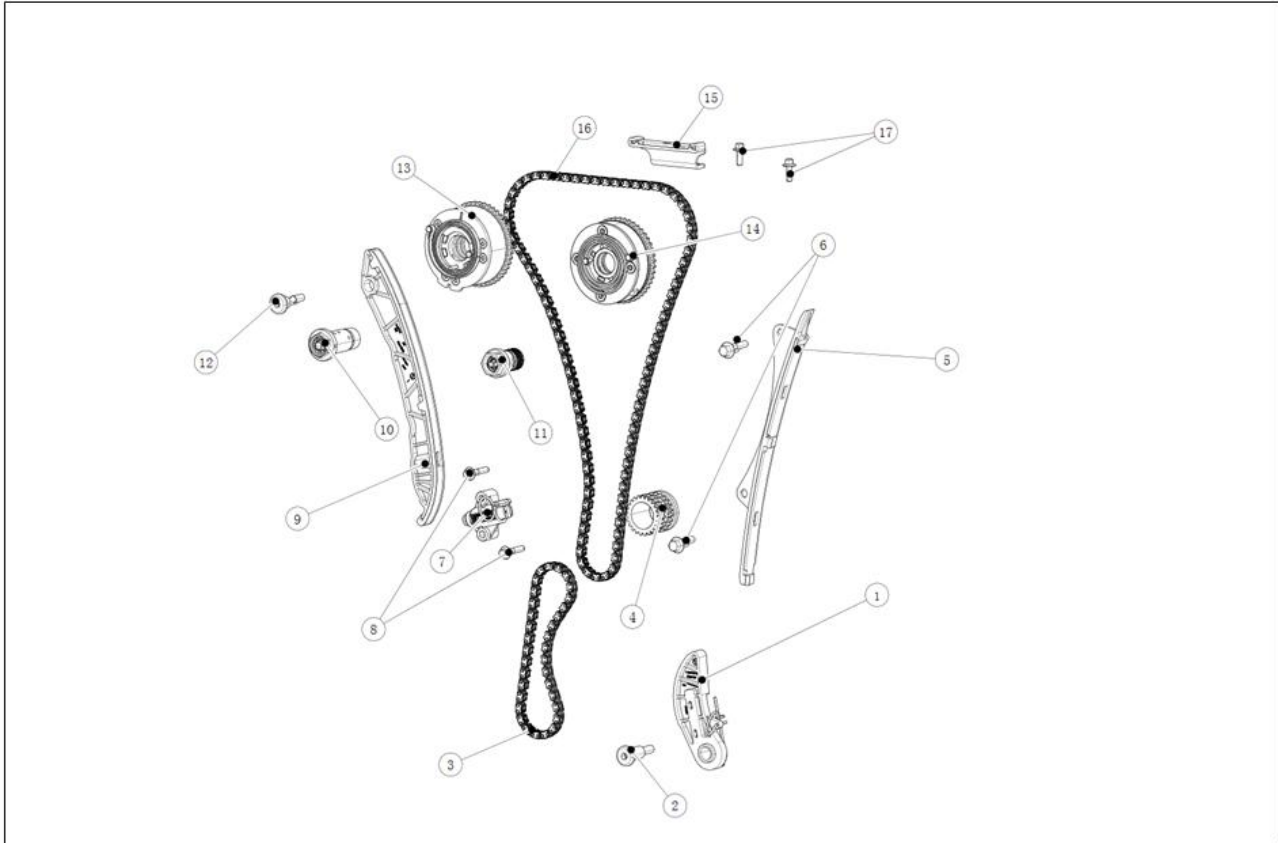
Exploded view

Front end gear train



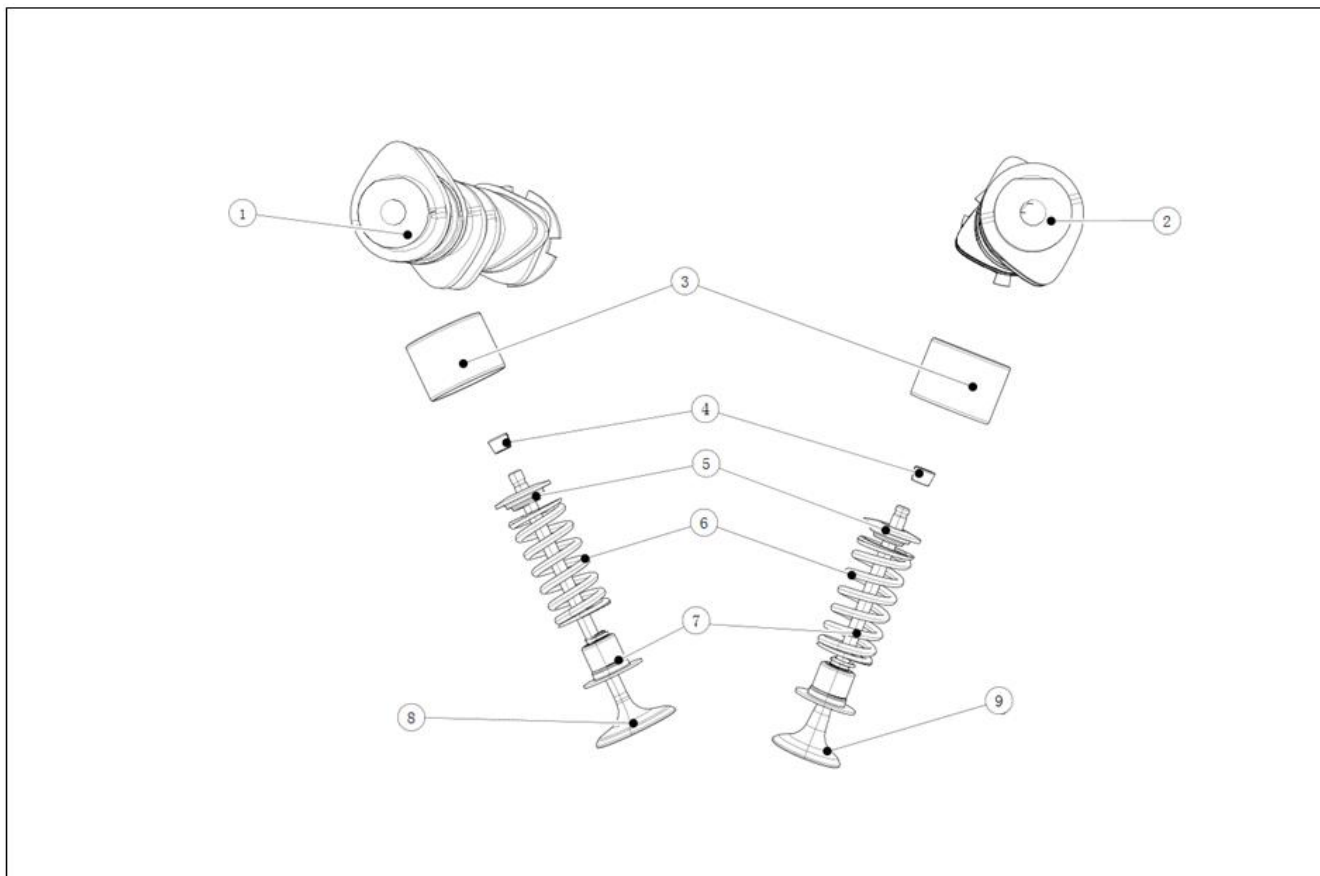
Project	Description	Project	Description
1	Crankshaft damping pulley assembly	5	Integral alternator assembly
2	Compressor assembly	6	Front end gear train tensioning
3	Water pump pulley	7	Front gear belt
4	Front gear train idler gear assembly		

## Timing mechanism



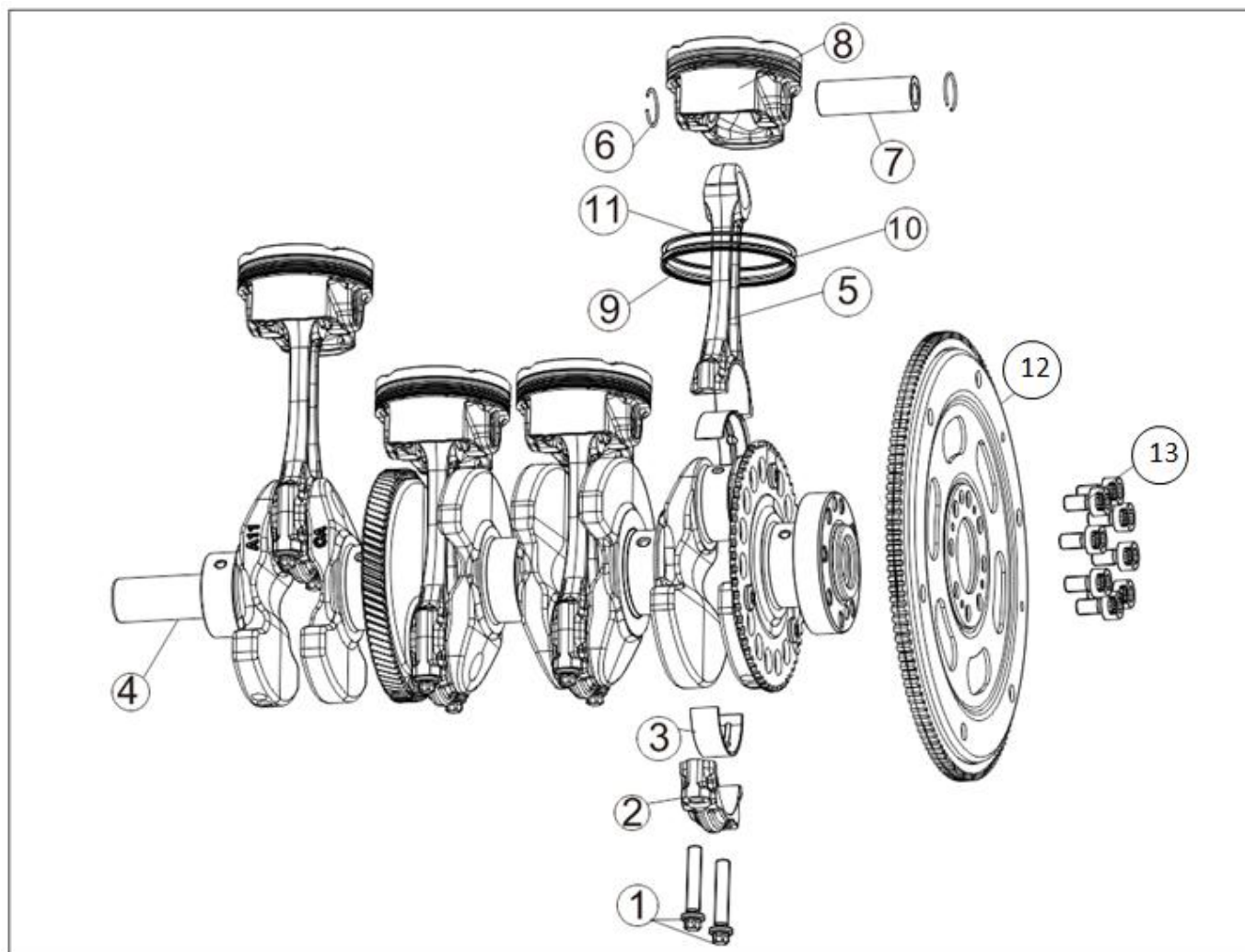
Project	Description	Project	Description
1	Engine oil pump chain tensioner assembly	10	Intake middle-mounted solenoid valve assembly
2	Oil pump chain tensioner mounting bolt	11	Exhaust middle type solenoid valve assembly
3	Oil pump chain assembly	12	Timing chain movable rail assembly mounting bolt
4	Crankshaft timing sprocket	13	Intake phaser assembly
5	Timing chain rail fixing assembly	14	Exhaust phaser assembly
6	Timing chain rail mounting bolt	15	Guide rail assembly between camshafts
7	Timing tensioner assembly	16	Timing chain assembly
8	Timing chain tensioner assembly mounting bolt	17	Guide rail mounting bolt between camshafts
9	Timing chain moving rail assembly		

## Valve mechanism

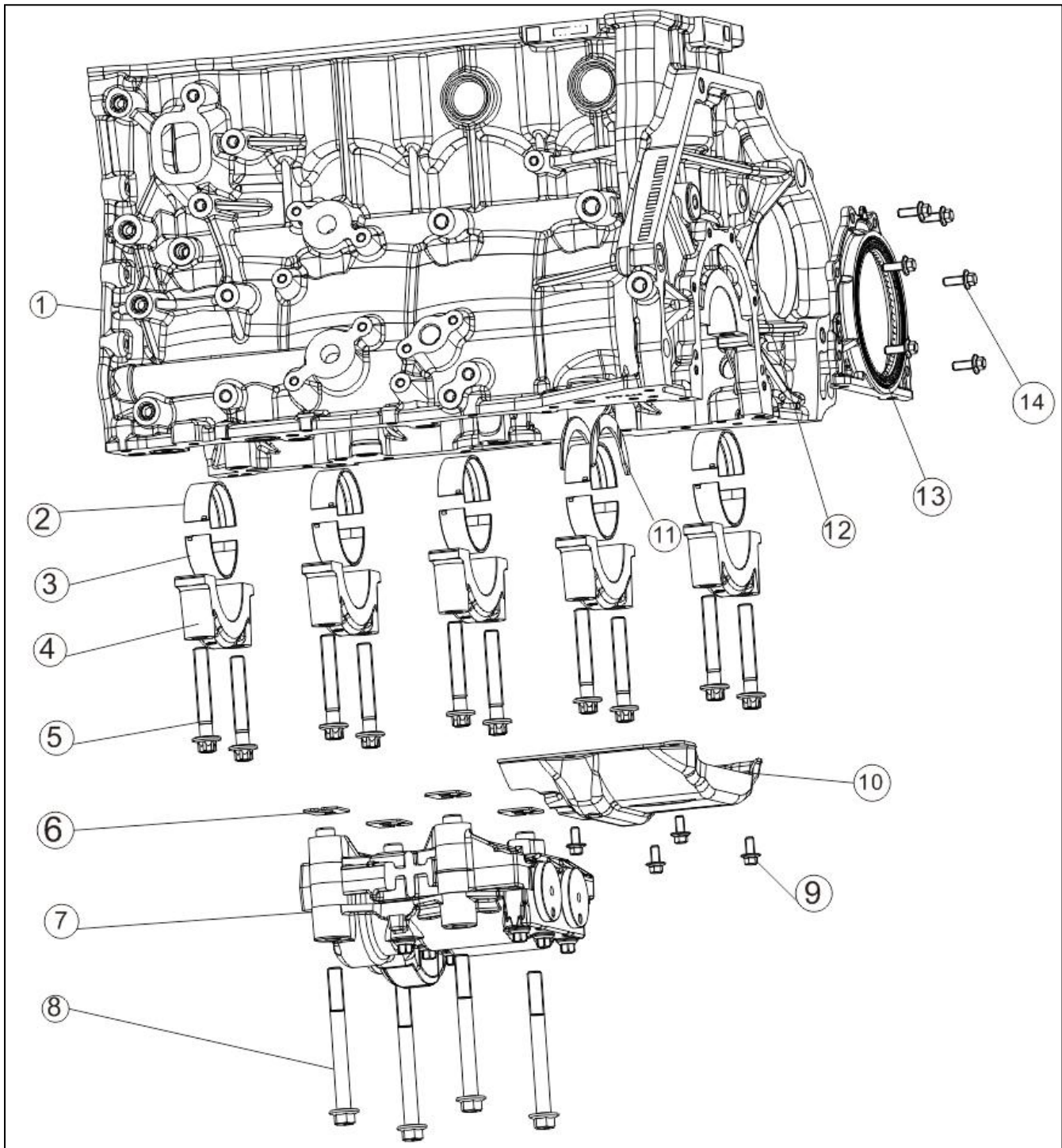


Project	Description	Project	Description
1	Intake camshaft assembly	6	Valve spring
2	Exhaust camshaft assembly	7	Valve stem seal
3	Mechanical tappet	8	Intake valve
4	Valve lock block	9	Exhaust valve
5	Valve spring seat		





Project	Description	Project	Description
1	Connecting rod bolt	8	Piston
2	Connecting rod cap	9	Combination oil ring
3	Connecting rod bearing shell	10	Scraper ring
4	Crankshaft	11	Gas ring
5	Connecting rod body	12	Drive plate
6	Piston pin snap ring	13	Drive plate bolt
7	Piston pin		



Project	Description	Project	Description
1	Crankcase sub-assembly	8	Connecting bolt between crankcase and balance shaft
2	Upper main bearing shell	9	Bolt
3	Lower main bearing shell	10	Crankcase lower reinforced plate
4	Main bearing cover	11	Thrust plate
5	Main bearing cap bolt	12	Locating pin
6	Balance shaft No.1 adjusting shim	13	Crankshaft rear end cover assembly

7	Balance shaft assembly	14	Screw plug
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## General inspection

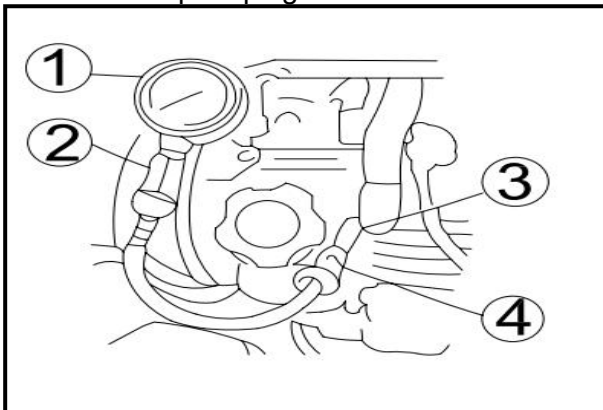
### Special tool

Serial number	Special tool
1	Valve spring lock block removal tool
2	Crankshaft front oil seal tool
3	Crankshaft rear sealing tool

### Cylinder pressure check

Check the compression pressure of the 4 cylinders as follows.

1. The engine warms up below normal operating temperature.
2. Shut down the engine after warm-up. After the engine warms up, place the transmission shift lever in the neutral position and fix the parking brake and counter at the drive wheel.
3. Disconnect the harness connector for the fuel injector.
4. Remove ignition coil assembly and all spark plugs.
5. Fit special tool (compression pressure gauge) into the spark plug bore.



Project	Special tool
1	Pressure gauge
2	Joint
3	Hose
4	Retainer

6. Place the transmission shift lever in the "neutral" position (lighten the engine starting load) and press the accelerator pedal as far as it will go to fully open the throttle valve.
7. Start the engine with a fully charged battery and read out the maximum pressure on the

compression pressure gauge.



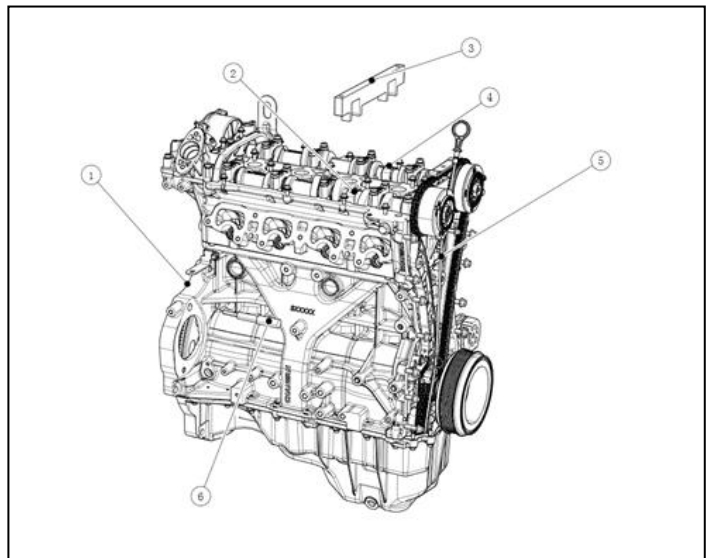
**Note:** In order to measure the compression pressure, the engine must be started with a fully charged battery so that the engine speed is at least 250 rpm.

8. Operate each cylinder in steps 5 to 7 and record the cylinder compression pressure.
9. Compare with the specifications in the following table:

Compression pressure	
Limit(Minimum)	1300kPa
Maximum pressure difference between two cylinders	100kPa

10. After inspection, install the spark plug and ignition coil assembly, and connect the fuel injector harness connector.

### Valve clearance check and adjustment



Project	Description
1	Rear end of engine
2	Camshaft timing mark
3	Camshaft timing tool
4	Camshaft timing mark
5	Front end of engine
6	Crankshaft timing tooling

1. Disconnect the battery negative wire.
2. Remove the cylinder head cover.
3. Rotate the crankshaft clockwise to make the

### 3.1.3 -10

### Mechanical system

### 3.1.3 -10

hexagonal mark facet of the two camshafts horizontally upward. At the same time, align the locating hole on the flywheel with the locating pin hole of the cylinder block, and fix the camshaft and crankshaft with special timing tool. Measure the intake valve clearance of cylinders 1 and 2 and exhaust valve clearance of cylinders 1 and 3 respectively with a feeler gauge.

4. Rotate the crankshaft clockwise to make the hexagonal mark facet of the two camshafts downward horizontally. At the same time, align the locating hole on the flywheel with the locating pin hole of the cylinder block, and fix the camshaft and crankshaft with special timing tool. Measure the intake valve clearance of cylinders 3 and 4 and exhaust valve clearance of cylinders 2 and 4 in turn with a feeler gauge.

5. If the valve clearance exceeds the standard, replace the corresponding valve tappet according to the clearance value to adjust the valve clearance, and then check again to ensure the valve clearance is within the specified standard.

Valve clearance standard (Assemble high-pressure oil pump and 10# camshaft cover)	Cold state(Coolant temperature 15-25℃)	
	Intake	0.20-0.24mm
	Exhaust	0.34-0.38mm

Tightening torque:  $12 \pm 2 \text{ N} \cdot \text{m}$  (7.5 ftlb.)

6. When all valves are inspected and adjusted, install them in the reverse order of removal.

### Timing mechanism check

1. Remove the engine cylinder head cover, rotate the crankshaft clockwise, and check whether the timing position of the engine timing mechanism is aligned with the timing tool clamp plate and timing pin.

2. Check the timing chain assembly, timing chain rail fixing assembly and timing chain moving rail assembly for wear and cracks, and replace if necessary.
3. Check the timing chain tensioner assembly to see if there is stagnation, and replace it if necessary.

### VVT Fault check

When the engine reports VVT related faults, refer to the following steps for troubleshooting.

1. Dismantle middle-type electromagnet assembly, observe whether there is abnormal (scratch, deformation, cleanliness, etc.) of middle-type electromagnet assembly thimble and clean it with engine oil or cleaning fluid;

2. Connect the wiring harness of the middle-mounted electromagnet assembly to the 12-14 V constant current (it is recommended to use the vehicle-mounted battery), and repeat the steps of contact-disconnect-contact with the wiring of the level negative electrode at a relatively fast frequency, as shown in the figure below;



3. If the thimble can be normally extended when it is energized, and can be easily pushed by hand when it is de-energized, it indicates that the middle-mounted electromagnet is normal, and reinstall it on the engine; Otherwise, it indicates that the middle-mounted electromagnetic assembly fails, and replace the middle-mounted electromagnetic assembly.

## Fault symptom diagnosis and test

### Inspection and confirmation

1. Confirm the problems raised by the customer and check accordingly.
2. Check appearance for obvious mechanical damage.
3. Resolve the discovered problem before proceeding to the next inspection.
4. If the cause cannot be confirmed from the appearance, confirm the symptoms first, and then check according to the symptom table.


### Appearance check list


Mechanical
<ul style="list-style-type: none"> <li>• coolant leakage</li> <li>• Oil leakage</li> <li>• Fuel leakage</li> <li>• Parts obviously damaged or worn</li> <li>• Loose or missing nut or bolt</li> </ul>

### Fault symptom table

Symptoms	Possible causes	Measures
Engine misfire	<ul style="list-style-type: none"> <li>• Electronic control system</li> <li>• Fuel system</li> <li>• Ignition system</li> <li>• Mechanical system               <ul style="list-style-type: none"> <li>- Combustion chamber carbon deposit</li> <li>- Camshaft</li> <li>- Intake and exhaust valves</li> <li>- Piston</li> <li>- Piston ring</li> <li>- Cylinder</li> <li>- Intake blocked</li> <li>- Poor exhaust</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• engine misfire is a comprehensive fault.</li> </ul>
Abnormal internal noise under the engine	<ul style="list-style-type: none"> <li>• Oil pan deformation</li> <li>• Oil strainer is deformed or damaged.</li> <li>• Oil pressure too low</li> <li>• Excessive clearance between crankshaft and bearing</li> <li>• Crankshaft axial clearance is too large</li> </ul>	<p>Reference: <a href="#">3.1.3 Mechanical system</a></p>



Accessory belt noise diagnosis	<ul style="list-style-type: none"> <li>• Front gear belt</li> <li>• Related fasteners</li> <li>• Tensioner wheel</li> <li>• Tensioner</li> <li>• Idler gear</li> <li>• Crankshaft torsional vibration damper assembly</li> <li>• Alternator</li> <li>• Water pump</li> <li>• A/C compressor</li> </ul>	Reference: 3.1.3 Mechanical system
Engine temper  Note: The fuel in the intake manifold is ignited, causing serious blasting noise.	<ul style="list-style-type: none"> <li>• Electronic control system fault</li> <li>• Engine timing</li> <li>• Mixture is too lean</li> <li>• Intake valve group</li> <li>• Exhaust system blocked</li> <li>• Engine control module</li> </ul>	Reference: 3.1.3 Mechanical system



Symptoms	Possible causes	Measures
Engine firing  Note: The fuel in the exhaust system is ignited, causing serious blasting noise.	<ul style="list-style-type: none"> <li>• Electronic control system fault</li> <li>• Engine timing</li> <li>• Ignition too late</li> <li>• Mixture too rich</li> <li>• Exhaust valve group</li> <li>• Exhaust system leakage</li> <li>• Engine control module</li> </ul>	Reference: 3.1.3 Mechanical system
Abnormal exhaust(White smoke)	• coolant enters combustion chamber	Reference: 3.1.3 Mechanical system
Abnormal exhaust(Blue smoke)	• Burning oil	Reference: 3.1.3 Mechanical system
Abnormal exhaust(Black smoke)	• mixture too rich	Reference: 3.1.3 Mechanical system
Cold knock for two or three minutes and/or knock increases with engine torque	• electronic control system fault	Reference: 3.1.2 On-board diagnosis
	• Engine oil viscosity too low	• Fill engine oil with viscosity consistent with expected seasonal temperature.
	• The clearance between piston and cylinder wall is too large.	Reference: 3.1.3 Mechanical system
	• Connecting rod positioning(End play, bending, twisting)	
Knock occurs during idling and	• Piston pin clearance is too large	Reference: 3.1.2 On-board
	• electronic control system fault	

### 3.1.3 -13

### Mechanical system

### 3.1.3 -13

warm-up		diagnosis
	• Engine oil viscosity too low	• Fill engine oil with viscosity consistent with expected seasonal temperature
	• Fuel quality	• Must use 92# and above fuel
	• Engine timing	Reference: 3.1.3 Mechanical system
	• Excessive clearance between piston and cylinder wall	Reference: 3.1.3 Mechanical system
	• Connecting rod positioning(End play, bending, twisting)	
Knock occurs during idling and warm-up	• Piston pin clearance is too large	Reference: 3.1.3 Mechanical system
Main bearing noise  ⚠ Note: Remove the accessory drive belt to rule out the noise caused by the accessory device and use a stethoscope to locate the engine noise.  ⚠ Note: The noise of main bearing can be heard when the engine is under load. Its noise is loud and dull. The louder the load, the louder the noise.  ⚠ Note: The tapping sound is regular and varies with the speed.  ⚠ Note: Low oil pressure will also occur with this condition.  ⚠ Note: If the oil is too thin or there is no oil on the bearing, the bearing will produce knocking noise.	• Oil pump pressure too low	Reference: 3.1.4 Lubrication system
	• Crankshaft axial clearance is too large	Reference: 3.1.3 Mechanical system
	• Crankshaft journal out of circle	
	• Excessive clearance between crankshaft and bearing	
Noise symptoms of connecting rod and connecting rod bearing	• Oil pump pressure too low	Reference: 3.1.3 Mechanical system
	• Large end side clearance of connecting rod exceeds the limit	
	Tightening torque of connecting rod bolt	
	• Connecting rod twist/bend out of range	
	• Crank roundness and taper out of range	
	• Connecting rod bearing clearance out of range	

Piston and piston pin noise	• Oil pump pressure too low	Reference: 3.1.3 Mechanical system
	• Incorrect connecting rod and piston installation	
	• Connecting rod twist/bend out of range	
	• Piston pin clearance is too large	
	• Excessive clearance between piston and cylinder wall	
	• Piston ring groove clearance is too large	
Valve drive group noise	• Oil pump pressure too low	Reference: 3.1.3 Mechanical system
	• Cam lobe damage	
	• Excessive clearance of camshaft journal	
	• The camshaft axial clearance is too large.	
	• Valve spring too soft	
	• Valve stuck	
Valve drive group noise	• Excessive clearance between valve stem and valve guide	Reference: 3.1.3 Mechanical system
	• Valve seat ring loose	
Engine cannot be started - crankshaft does not rotate	• Accessory driveline components stuck	Reference: 3.1.3 Mechanical system
	• cylinder stuck due to hydraulic pressure	
	• Camshaft stuck or broken	
	• Valve system component is stuck or broken	
	Foreign matter in • cylinder	
	• Crankshaft or connecting rod bearing stuck	
	• The connecting rod is bent or broken.	
	• Crankshaft fracture	
Coolant enters combustion chamber  Note: White smoke and/or gases with coolant odor are discharged from exhaust trachea in excess of the acceptable range.  Note: Remove the spark plug. The spark plug is immersed	• Engine overheating - Coolant level too low - Cooling fan does not work - Thermostat fault	Reference: 3.1.3 Mechanical system
	• Cylinder head gasket has fault	• Replace cylinder head gasket. Reference: 3.1.3 Mechanical system
	• Cylinder head warping	• Replace cylinder head and



with coolant.		gasket. <a href="#">Reference: 3.1.3 Mechanical system</a>
	• Cylinder head cracking	• Replace cylinder head and gasket. <a href="#">Reference: 3.1.3 Mechanical system</a>
	• Cracking of cylinder liner or cylinder block	• Replace cylinder head. <a href="#">Reference: 3.1.3 Mechanical system</a>
	• Porosity in cylinder head or cylinder block	• Replace cylinder head or cylinder block. <a href="#">Reference: 3.1.3 Mechanical system</a>
Coolant into engine oil  <a href="#">Note: Engine oil is foam and discolored.</a>  <a href="#">Note: "Excessive" engine oil</a>	• Engine overheating - Coolant level too low - Cooling fan does not work - Thermostat fault	<a href="#">Reference: 3.1.5 Cooling system</a>
	• Cylinder head gasket fault	• Replace cylinder head gasket. <a href="#">Reference: 3.1.3 Mechanical system</a>
Coolant into engine oil  <a href="#">Note: Engine oil is foam and discolored.</a>  <a href="#">Note: "Excessive" engine oil</a>	• Cylinder head warping	• Replace cylinder head and gasket. <a href="#">Reference: 3.1.3 Mechanical system</a>
	• Cylinder head cracking	• Replace cylinder head and gasket. <a href="#">Reference: 3.1.3 Mechanical system</a>
	• Cracking of cylinder liner or cylinder block	• Replace the cylinder block. <a href="#">Reference: 3.1.3 Mechanical system</a>
	• Porosity in cylinder head or cylinder block	• Replace cylinder head or cylinder block. <a href="#">Reference: 3.1.3 Mechanical system</a>

### Abnormal internal noise under the engine

 [Note: Using the stethoscope will help determine where engine noise is generated.](#)






 [Note: Remove accessory drive belt to rule out noise caused by these devices.](#)

Test conditions	Details/Results/Measures
Check knock DTC	
	A. Use a scan tool to detect whether there is knock. ? Yes <a href="#">Reference: 3.1.2 On-board diagnosis.</a>

	<p>? No</p> <p>Go to step 2.</p>
Check oil pan	
	<p>A. Check oil pan.</p> <p>Is it deformed?</p> <p>? Yes</p> <p>After repair or replacement, go to Step 3.</p> <p>? No</p> <p>Go to Step 3.</p>
Check oil pump filter	
	<p>A. Inspect whether the oil pump filter screen is deformed or damaged.</p> <p>Is the oil pump strainer deformed or damaged?</p> <p>? Yes</p> <p>Repair or replace.</p> <p>? No</p> <p>Go to Step 4.</p>
Oil pressure too low	
	<p>A. Check oil pressure.</p> <p>Reference: 3.1.4 Lubrication system</p> <p>Is the pressure too low?</p> <p>? No</p> <p>Go to Step 6.</p> <p>? Yes</p> <p>Go to Step 5.</p>
Check oil pump	
	<p>Remove oil pump.</p> <p>Reference: 3.1.4 Lubrication system</p> <p>Check whether the oil pump is normal?</p> <p>? No</p> <p>Replace oil pump.</p> <p>? Yes</p> <p>Go to Step 6.</p>
6. Check bearing shell fit clearance and crankshaft axial clearance	

	<p>Disassemble main bearing shell and connecting rod bearing shell.</p> <p>Reference: 3.1.3 Mechanical system</p> <p>Check engine main bearing bush and connecting rod bearing bush mating clearance and crankshaft thrust plate wear</p> <p>Whether the fitting clearance and crankshaft axial clearance are normal?</p> <p>? No</p> <p>Repair engine main bearing shell, connecting rod bearing shell mating clearance and crankshaft axial clearance to normal.</p> <p>Reference: 3.1.3 Mechanical system</p> <p>? Yes</p> <p>The test system works properly.</p>
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## Front gear train belt noise diagnosis

-  Note: Using the stethoscope will help determine where engine noise is generated.
-  Note: Be sure to use correct FRT gear train belt.
-  Note: Coplanarity (coplanarity of crankshaft torsional vibration damper assembly and relevant accessory pulley) may cause abnormal wear, noise and falling off of drive belt.
-  Note: Sudden increase of large load may cause belt slippage and emit noise, such as air conditioning system compressor starting, throttle valve opening quickly when the engine is running, etc.
-  Note: Excessive load may also cause abnormal belt noise, such as excessive filling of A/C system, flat hose clamping of power steering system and excessive power steering fluid.

Test conditions	Details/Results/Measures
1. Check front wheel train belt	
	<p>A. Remove the front wheel train belt.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Abnormal sound disappears: Check whether the front gear train belt is broken, foreign matter is stuck, etc.</p> <p>Is there any of the above?</p> <p>? Yes</p> <p>Replace front wheel train belt.</p> <p>? No</p> <p>Go to Step 2</p> <p>Abnormal sound exists: Check other systems.</p>
2. Check relevant fasteners	
	<p>A. Check all fasteners associated with the front gear train belt for looseness or deformation.</p> <p>Is there any looseness or deformation</p> <p>? Yes</p> <p>Tighten or replace.</p> <p>? No</p> <p>Go to Step 3.</p>
3. Check front end gear train tensioning wheel assembly	
	<p>A. Remove front wheel train belt.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>B. The bearing shall be free of jamming, abnormal sound, etc.</p> <p>C. The pulley surface shall be free of distortion, crack, etc.</p> <p>D. The body shall be free of cracking, fracture, etc.</p> <p>E. Do not loosen the pulley bolts.</p> <p>Is there any of the above?</p> <p>? Yes</p> <p>Tighten or replace.</p> <p>? No</p> <p>Go to Step 4.</p>

Test conditions	Details/Results/Measures
4. Check front gear train idler gear assembly	
	<p>A. Bearing can not be stuck, abnormal sound, etc.  B. The pulley surface shall be free of distortion, crack, etc.  C. The pulley bolt must not be loose.</p> <p>Is there any of the above?  ? Yes  Tighten or replace.  ? No  Go to Step 5.</p>
5. Check pulley of crankshaft torsion damper assembly and related accessories	
	<p>A. The pulley shall be free of distortion, crack, etc.  B. Whether there is foreign matter in the wheel groove.</p> <p>Is there any of the above?  ? Yes  Remove foreign objects, tighten or replace components.  ? No  Go to Step 6.</p>
6. Check alternator, water pump and A/C compressor bearings one by one	
	<p>A. The bearing shall be free of jamming, abnormal sound, etc.</p> <p>Is there any of the above?  ? Yes  Replace.  ? No  Check the system.</p>

**Engine temper**

Test conditions	Details/Results/Measures
1. Check engine DTCs	
	<p>A. Use a scan tool to detect engine DTCs.</p> <p>Is there a DTC?</p> <p>? Yes</p> <p><a href="#">Reference: 3.1.2 On-board diagnosis</a></p> <p>? No</p> <p>Go to step 2.</p>
2. Check the vacuum of intake system	
	<p>A. Inspect the intake system vacuum degree to judge the intake system.</p> <p><a href="#">Reference: Intake system vacuum check</a></p> <p>Air leakage?</p> <p>? Yes</p> <p>Perform repairs.</p> <p><a href="#">Reference: Intake leakage diagnosis process</a></p> <p>? No</p> <p>Go to Step 3.</p>
3. Check fuel pressure	
	<p>A. Check fuel pressure.</p> <p><a href="#">Reference: Fuel System Pressure Test</a></p> <p>Is the oil pressure too low?</p> <p>? Yes</p> <p>Perform symptom measures.</p> <p><a href="#">Reference: Fault symptom table</a></p> <p>? No</p> <p>Go to Step 4.</p>
4. Check fuel injector	
	<p>A. Check fuel injector.</p> <p>Is it blocked?</p> <p>? Yes</p> <p>Clean or replace.</p> <p>? No</p> <p>Go to Step 5.</p>

Test conditions	Details/Results/Measures
5. Spark plug test	
	<p>A. Conduct spark plug test.</p> <p>Within specifications.</p> <p><a href="#">Reference: Ignition spark test</a></p> <p>? No</p> <p>Clean or replace.</p> <p>? Yes</p> <p>Go to Step 6.</p>
6. Check cylinder pressure	
	<p>A. Perform cylinder pressure check.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Is it within the standard range?</p> <p>? Yes</p> <p>Go to Step 7.</p> <p>? No</p> <p>Perform repairs.</p>
7. Check exhaust system	
	<p>A. Perform exhaust back pressure test to check whether the exhaust system is blocked.</p> <p><a href="#">Reference: Exhaust back pressure test</a></p> <p>Is it blocked?</p> <p>? Yes</p> <p>Perform the exhaust system blockage diagnosis procedure.</p> <p><a href="#">Reference: Exhaust system blockage diagnosis process</a></p> <p>? No</p> <p>Go to Step 8.</p>
8. Check engine timing	
	<p>A. Check whether the engine timing is correct.</p> <p><a href="#">Reference: Timing check(Mechanical system 3.1.2-10)</a></p> <p>Is the system normal?</p> <p>? No</p> <p>Perform repairs.</p> <p>? Yes</p> <p>Go to step 9.</p>
9. Replace engine control module	
	<p>A. Replace the engine control module.</p> <p><a href="#">Reference: Engine control module</a></p> <p>Verify the system works properly.</p>

**Engine firing**

Test conditions	Details/Results/Measures
1. Check engine DTCs	
	<p>A. Use a scan tool to detect engine DTCs.</p> <p>Is there a DTC?</p> <p>? Yes</p> <p><a href="#">Reference: 3.1.2 On-board diagnosis</a></p> <p>? No</p> <p>Go to step 2.</p>
2. Check fuel pressure	
	<p>A. Check fuel pressure.</p> <p><a href="#">Reference: Fuel pressure check</a></p> <p>Is the oil pressure too high?</p> <p>? Yes</p> <p>The fuel line is blocked and the line is repaired.</p> <p>? Yes</p> <p>Go to Step 3.</p>
3. Check fuel injector	
	<p>A. Inspect whether the fuel injector leaks.</p> <p>Is it leaking?</p> <p>? Yes</p> <p>Clean or replace.</p> <p>? No</p> <p>Go to Step 4.</p>
4. Spark plug test	
	<p>A. Check whether the spark plug test is within specifications.</p> <p><a href="#">Reference: Ignition spark test</a></p> <p>Is it within the standard range?</p> <p>? No</p> <p>Clean or replace.</p> <p>? Yes</p> <p>Go to Step 5.</p>
5. Check cylinder pressure	
	<p>A. Perform cylinder pressure check.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Is it within the standard range?</p> <p>? Yes</p> <p>Go to Step 6.</p> <p>? No</p> <p>Perform repairs.</p>
6. Check exhaust system	



	<p>A. Perform exhaust back pressure test.</p> <p><a href="#">Reference: Exhaust back pressure test</a></p> <p>Is the exhaust system leaking?</p> <p>? Yes</p> <p>Perform the exhaust system leak and noise diagnostic procedure.</p> <p><a href="#">Reference: Fault symptom table</a></p> <p>? No</p> <p>Go to Step 7.</p>
7. Check engine timing	
	<p>A. Inspect the engine timing.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Is the timing normal?</p> <p>? No</p> <p>Perform repairs.</p> <p>? Yes</p> <p>Go to Step 8.</p>
8. Replace engine control module	
	<p>A. Replace the engine control module.</p> <p><a href="#">Reference: Engine control module</a></p> <p>Verify the system works properly.</p>

**Abnormal exhaust(Blue smoke)**

Note: Usually with spark plug carbon deposit



Note: Use engine oil meeting specifications






Test conditions	Details/Results/Measures
1. Check spark plug	
	A. Inspect the spark plug. Is there carbon deposit? ? Yes Clean or replace. ? No Go to step 2.
2. Check engine oil	
	A. Inspect the engine oil level. Is the oil level too high? ? Yes Return to normal level. ? No Go to Step 3.
3. Check PCV valve	
	A. Check PCV valve. Is it normal? ? No Replace PCV valve. ? Yes Go to Step 4.
4. Check cylinder compression pressure	
	A. Check whether the cylinder compression pressure does not meet the requirements.  <a href="#">Reference: 3.1.3 Mechanical system</a> ? Yes Go to Step 5. ? No Go to Step 6.
5. Check piston ring or valve fault	
	A. Add an appropriate amount of engine oil into the cylinder block. ? Significantly increased pressure, check piston rings.  <a href="#">Reference: 3.1.3 Mechanical system</a> ? The pressure does not increase much, check the valve.

	<a href="#">Reference: 3.1.3 Mechanical system</a>
6. Check combustion chamber carbon deposit	
	A. Check combustion chamber. Is there carbon deposit? ? Yes Perform cleaning. ? No Go to Step 7.
7. Check valve stem seal	
	A. Inspect valve stem seal. Is it leaking? ? Yes Replace. <a href="#">Reference: 3.1.3 Mechanical system</a> ? No Verify the system works properly.

**Abnormal exhaust(Black smoke)**

Test conditions	Details/Results/Measures
1. Check engine DTCs	
	A. Use a scan tool to detect engine DTCs. Is there a DTC? ? Yes <a href="#">Reference: 3.1.2 On-board diagnosis</a> ? No Go to step 2.
2. Check fuel pressure	
	A. Check fuel pressure. Is it too high? <a href="#">Reference: Fuel System Pressure Test</a> ? Yes The fuel line is blocked and the line is repaired. ? Yes Go to Step 3.
3. Check fuel injector	
	A. Check fuel injector. Is it leaking? ? Yes Replace. ? No Go to Step 4.
4. Spark plug test	
	A. Conduct spark plug test. Does it meet the requirements? <a href="#">Reference: Ignition spark test</a> ? No Clean or replace. ? Yes Go to Step 5.
5. Replace engine control module	
	A. Replace the engine control module. <a href="#">Reference: Engine control module</a> Verify the system works properly.





## Noise symptoms of connecting rod and connecting rod bearing

-  Note: Remove the front gear train belt and strictly limit the engine running time. Otherwise, the engine may be damaged at high temperature.
-  Note: Using the stethoscope will help determine where engine noise is generated.
-  Note: Remove front gear train belt to rule out noise caused by accessory unit.
-  Note: The noise can sometimes be quarantined by removing one fuel injector harness plug at a time. If the noise volume decreases or disappears, the noise is related to the cylinder in which it is located.
-  Note: Excessive clearance of connecting rod will cause knocking noise at various engine speeds, and low oil pressure will occur with this situation.

Test conditions	Details/Results/Measures
1. Confirm the fault is not caused by noise caused by accessory device.	
	<p>A. Remove the front wheel train belt.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Is noise present?</p> <p>? No</p> <p>Noise from accessories.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to step 2.</p>
2. Check oil pump pressure	
	<p>A. Check the low oil pump pressure.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>Is the oil pump pressure too low?</p> <p>? Yes</p> <p>Perform repairs.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>? No</p> <p>Go to Step 3.</p>
3. Cylinder cut-off check	
	<p>A. Conduct cylinder cut-off test by removing the fuel injector harness plug to confirm which engine cylinder the noise is related to.</p> <p>Go to Step 4.</p>
4. Check large end side clearance of connecting rod	
	<p>A. Check the large end side clearance of connecting rod.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Replace connecting rod.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to Step 5.</p>

Test conditions	Details/Results/Measures
5. Check tightening torque of connecting rod bolt	
	<p>A. Check the tightening torque of connecting rod bolts.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Record the torque and replace the bolts and nuts.</p> <p>? Yes</p> <p>Go to Step 6.</p>
6. Check twist/bend of connecting rod	
	<p>A. Check that the connecting rod is twisted/bent within specifications.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Replace connecting rod.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to Step 7.</p>
7. Check crank roundness and taper	
	<p>A. Check crank roundness and taper.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? No</p> <p>Repair or replace the crankshaft.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to Step 8.</p>
8. Check clearance between connecting rod and crank	
	<p>A. Check the clearance between connecting rod and bearing.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Repair to within specifications.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Verify the system works properly.</p>

## Piston and piston pin noise


-  Note: Remove the front gear train belt and strictly limit the engine running time. Otherwise, the engine will be damaged at high temperature.
-  Note: Using the stethoscope will help determine where engine noise is generated.
-  Note: Remove front gear train belt to rule out noise caused by accessory unit.
-  Note: The knocking sound caused by excessive clearance between piston and cylinder wall can be heard during engine idling. When the fuel injector harness plug of this cylinder is removed, the tapping sound will change significantly.

Test conditions	Details/Results/Measures
1. Confirm the fault is not caused by noise caused by accessory device.	
	<p>A. Remove the front wheel train belt.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Is noise present?</p> <p>? No</p> <p>Noise from accessories.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to step 2.</p>
2. Check oil pump pressure	
	<p>A. Check the low oil pump pressure.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>Is the oil pump pressure too low?</p> <p>? Yes</p> <p>Perform repairs.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>? No</p> <p>Go to Step 3.</p>
3. Cylinder cut-off check	
	<p>A. Conduct cylinder cut-off test by removing the fuel injector harness plug to confirm which engine cylinder the noise is related to.</p> <p>Go to Step 4.</p>
4. Check the installation of connecting rod and piston	
	<p>A. Check the installation position of connecting rod and piston.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Reinstall.</p> <p>? Yes</p> <p>Go to Step 5.</p>

Test conditions	Details/Results/Measures
5. Check twist/bend of connecting rod	
	<p>A. Check that the connecting rod is twisted/bent within specifications.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> Does it meet the requirements? ? No Replace connecting rod.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> ? Yes Go to Step 6.</p>
6. Check piston pin clearance	
	<p>A. Check whether the piston pin clearance is within the specification.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> Does it meet the requirements? ? No Repair.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> ? Yes Go to Step 7.</p>
7. Check piston ring groove clearance	
	<p>A. Check whether the piston ring groove clearance is within the specification.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> Does it meet the requirements? ? No Repair to within specifications.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> ? Yes Go to Step 8.</p>
8. Check the clearance between piston and cylinder wall	
	<p>A. Check whether the clearance between piston and cylinder wall is within specifications.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> Does it meet the requirements? ? No Repair to within specifications.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a> ? Yes Verify the system works properly.</p>



**Valve drive group noise**

 **Note:** Remove the front gear train belt and strictly limit the engine running time. Otherwise, the engine may be damaged at high temperature.



**Note:** Using the stethoscope will help determine where engine noise is generated.



**Note:** Remove front gear train belt to rule out noise caused by accessory unit.

Test conditions	Details/Results/Measures
1. Confirm that the noise is not caused by the accessory device	
	<p>A. Remove the front wheel train belt.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Is noise present?</p> <p>? No</p> <p>Noise from accessories.</p> <p>? Yes</p> <p>Go to step 2.</p>
2. Check oil pressure	
	<p>A. Check oil pump pressure.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>Is the pressure too low?</p> <p>? Yes</p> <p>Perform repairs.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>? No</p> <p>Go to Step 3.</p>
3. Check valve tappet component	
	<p>A. Check the clearance of mechanical tappet.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? Yes</p> <p>Replace the mechanical tappet.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? No</p> <p>Go to Step 4.</p>
4. Check camshaft cam height	
	<p>A. Check camshaft cam height.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Replace.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to Step 5.</p>

Test conditions	Details/Results/Measures
5. Check camshaft journal clearance	
	<p>A. Check the camshaft journal clearance.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Repair.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to Step 6.</p>
6. Check camshaft axial clearance	
	<p>A. Check camshaft axial clearance.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Repair.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to Step 7.</p>
7. Check valve spring	
	<p>A. Inspect whether the valve spring is within the specification.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Replace.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to Step 8.</p>
8. Check valve jamming	
	<p>A. Inspect whether the valve is stuck.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Is it stuck?</p> <p>? Yes</p> <p>Repair or replace the relevant components.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? No</p> <p>Go to step 9.</p>
9. Clearance between valve stem and valve guide	

	<p>A. Check the clearance between valve stem and valve guide.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? No</p> <p>Repair or replace the relevant components.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? Yes</p> <p>Go to step 10.</p>
10. Valve seat loose	
	<p>A. Check whether the valve seat ring is loose.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does it meet the requirements?</p> <p>? Yes</p> <p>Repair or replace the relevant components.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? No</p> <p>Verify the system works properly.</p>

**Engine cannot be started - crankshaft does not rotate**

Test conditions	Details/Results/Measures
1. Check accessory driveline components	
	<p>A. Remove the front gear train belt and try to turn the crankshaft with a wrench.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>Does the crankshaft rotate freely?</p> <p>? Yes</p> <p>Repair or replace accessory driveline components.</p> <p>? No</p> <p>Go to step 2.</p>
2. Check that the cylinder is stuck due to hydraulic pressure.	
	<p>A. Remove all spark plugs and check for water/oil/antifreeze.</p> <p>Does it meet the requirements?</p> <p>? Yes</p> <p>Inspect the cylinder block, cylinder head and cylinder head gasket for cracks, inspect or repair.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? No</p> <p>Go to Step 3.</p>
3. Check cylinder head assembly	
	<p>A. Remove timing mechanism.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>B. Check cylinder head.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <ul style="list-style-type: none"> <li>• Camshaft is stuck or broken.</li> <li>• Valve tappet is stuck.</li> <li>• Valve, valve spring is stuck or broken.</li> </ul> <p>Is there any of the above?</p> <p>? Yes</p> <p>Repair or replace.</p> <p>? No</p> <p>Go to Step 4.</p>

Test conditions	Details/Results/Measures
4. Check cylinder block assembly	
	<p>A. Inspect the cylinder block assembly.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>The piston is broken.</p> <p>Foreign matter in cylinder.</p> <p>Crankshaft broken.</p> <p>The connecting rod is bent or broken.</p> <p>Is there any of the above?</p> <p>? Yes</p> <p>Repair or replace.</p> <p>? No</p> <p>Verify the system works properly.</p>

## Removal and installation

### Engine assembly

#### Removal

1. Lower the fuel pressure in the fuel pipe according to the fuel pressure relief procedure described above.
2. Disconnect the harness connector and sensor connector to the engine.
3. Remove battery and battery box.
4. Drain the transmission oil.
5. Drain the cooling water.
6. Remove air inlet trachea and brake vacuum pipe.
7. Disconnect all connections to the engine fuel system.
8. Disconnect all connections to the engine cooling system.
9. Disconnect all connections to the engine control airway lines.
10. Disconnect all clips related to the engine wire harness.
11. Lift the vehicle.
12. Drain the engine oil.
13. Disconnect the three-way catalytic converter from the muffler.
14. Disconnect the transmission and shift cables.
15. Remove engine right bracket bolts and left, front and rear cushion bolts.
16. Take engine assembly with transmission out of the engine compartment.
17. Separate the engine from the transmission.
18. Remove engine front gear train, cylinder head cover and intake and exhaust systems as described above.
19. Remove the engine oil pan and timing mechanism as described above.
20. Remove the engine cylinder head as described above.
21. Remove the engine crank linkage as described above.

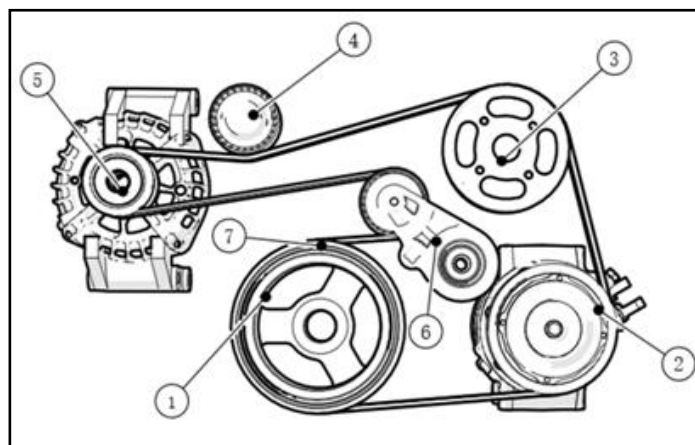
#### Installation

1. Install the engine body according to the reverse of the removal procedure, and tighten the bolts

with the torque specified in the torque specification sheet.

2. Connect the engine and transmission and tighten the bolts to the specified torque.
3. Put the engine assembly with transmission into the engine compartment, and tighten the right engine bracket bolts and the left, front and rear cushion bolts.
4. Refer to "2.2 Transmission Fuel System," connect the shift mechanism cable to the transmission shift mechanism control lever.
5. Connect the parking brake cable to the parking brake lever. Refer to "Parking brake inspection and adjustment" to adjust the parking brake.
6. Connect the corresponding wire harness plug on the engine.
7. Check to ensure that all removed components are reinstalled in the original location and that no reinstalled components are reinstalled.
8. Refill the engine with engine oil according to the "Engine oil change" clause.
9. Refill the engine coolant and drain the air from the system.
10. Connect the negative wire of the battery (battery).
11. Inspect each joint for fuel leakage, coolant leakage and exhaust leakage.

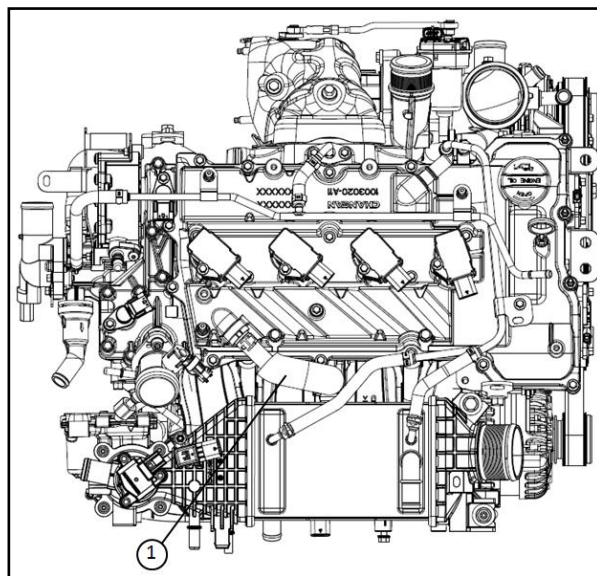
### Front end gear train



Project	Description
1	Crankshaft torsional damper assembly
2	A/C compressor assembly
3	Water pump pulley
4	Front gear train idler gear assembly

5	Integral alternator assembly
6	Front end gear train tensioning wheel assembly
7	Front gear belt

cover.



Project	Description
1	Pressure regulating valve vent hose

## Removal

1. Use a tool to pull the front gear train tensioner assembly counterclockwise.
2. Remove the belt and loosen the tensioning pulley slowly.
3. Remove the front gear train tensioner assembly, A/C compressor assembly, water pump pulley, front gear train idler assembly, integral alternator assembly and crankshaft torsional damper assembly in sequence.
4. Check whether each accessory pulley rotates flexibly, whether it is polluted by oil dirt, mud water, etc., whether there is breakage or damage in the wedge groove of the pulley, and replace in case of abnormality.

## Installation

1. Install crankshaft torsion damper assembly, integral alternator assembly, front gear train idler assembly, water pump pulley, A/C compressor assembly and front gear train tensioner assembly in corresponding positions of the engine in sequence, and tighten bolts according to specified torque.



**Note:** Crankshaft pulley combination bolt can only be reused once, and must be replaced after the second removal.

2. As shown in the above figure, wind the belt around the front end gear train side, use a tool to pull the front end gear train tensioning wheel assembly counterclockwise, insert the belt, and slowly loosen the tensioning wheel.
3. Check whether the belt is fitted in the wedge groove. If there is any abnormality, remove the belt and repeat installation step 2 again.

## Cylinder head cover

### Removal

1. Disconnect the positive and negative battery wires, and remove the battery.
2. Remove engine trim cover, ignition coil, oil dipstick, supercharger inlet and outlet pipes, overflow trachea, etc.
3. Disengage breather hose from cylinder head

4. Remove cylinder head cover with cylinder head cover gasket.

### Installation

1. Fit cylinder head cover sealing ring correctly into cylinder head cover.



**Note:** Before installation, check each part for deterioration or damage. If any defect is found, replace it.

2. Fit cylinder head cover on the cylinder head and tighten the bolts to the specified torque.



**Note:** When installing the cylinder head cover, carefully prevent the cylinder head cover sealing ring from displacing or falling off.

3. Connect breather hose to cylinder head cover.
4. Install ignition coil, oil dipstick, supercharger inlet and outlet pipes, overflow trachea, etc.
5. Connect positive and negative battery wires.

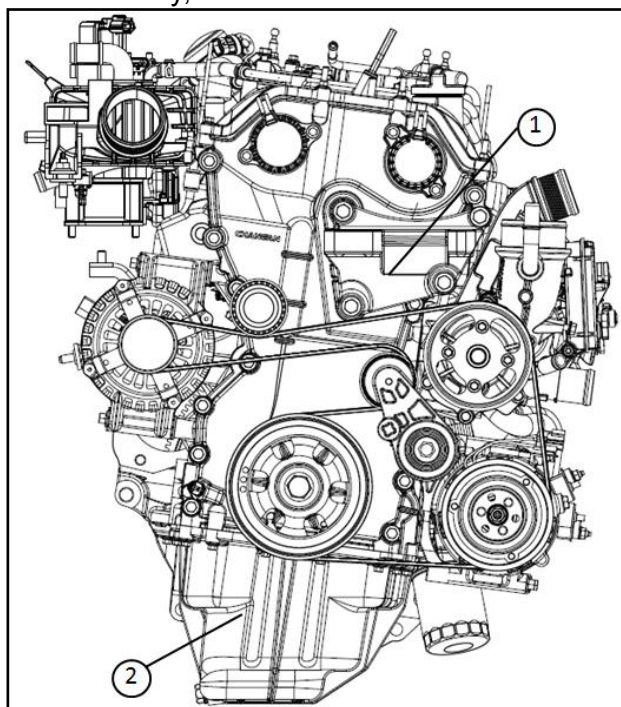


**Warning:** When the supercharger assembly is in hot state, do not repair it to avoid burns. When the system is cooled, it can be repaired.

## Timing mechanism

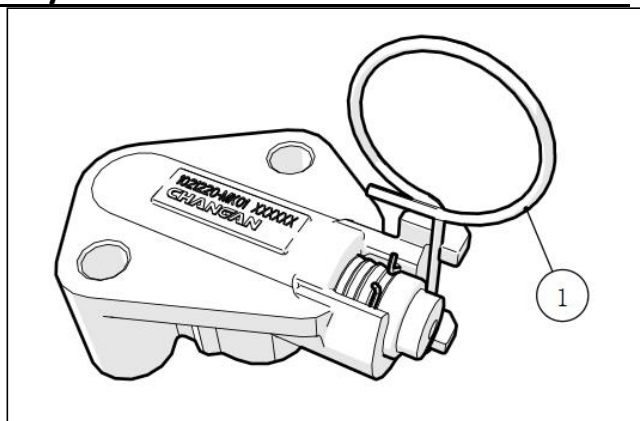
### Removal

1. Disconnect negative battery wire.
2. Drain engine coolant and engine oil.
3. Before removing the timing chain, use special timing tooling to install and position the camshaft and flywheel to prevent rotation. Use timing clamp plate at the upper end to position the hexagonal mark plane of intake and exhaust camshaft assembly in a horizontal upward position. Use the timing pin at the lower end to position the drive disk in the correct timing position.
4. Rotate the front gear train tensioner assembly counterclockwise, remove the front gear train belt, and then remove the A/C compressor assembly, water pump pulley, front gear train idler assembly, integral alternator assembly, and crankshaft torsional damper assembly in sequence.
5. Remove the right suspension bracket, oil pan assembly, etc.



Project	Description
1	Right suspension bracket
2	Oil pan assembly

6. Remove front cover assembly.
7. Lock timing chain tensioner piston with latch, remove timing chain tensioner connecting bolt, and finally remove timing chain tensioner.



Project	Description
1	Tensioner pin

8. Remove the movable rail connecting bolt, fixed rail bolt and inter-axle guide rail bolt in sequence, and then remove the movable rail, fixed rail and inter-axle guide rail.
9. Remove timing chain assembly.
10. Dismantle middle-mounted solenoid valve assembly, and then dismantle intake and exhaust phaser assembly.

### Cleaning

Clean the joint surface between the front cover assembly and the cylinder head, cylinder block, oil pan, remove the oil, old sealant and dirt on the joint surface, and clean the tensioner assembly, guide rail and timing chain.

### Installation

1. Fix timing position

Before installing the timing chain, use special timing tooling to install and position the camshaft and flywheel to prevent rotation. Use timing clamp plate at the upper end to position the hexagonal mark plane of intake and exhaust camshaft assembly in a horizontal upward position. Use the timing pin at the lower end to position the drive disk in the correct timing position.

2. Installing VVT phase

Before installing the phaser, keep the timing tool to position the camshaft timing phase; When installing the phaser, confirm that the installation end surface of the phaser is clean, the laser etching pattern is complete, and there are no problems such as scratches and crushing. Confirm that the thread of the middle-mounted solenoid valve assembly is free of bad teeth and missing teeth. Push the rear end thimble of the middle-mounted solenoid valve assembly by hand to ensure that



there are no problems such as jamming or jam. First bring the middle-mounted solenoid valve into the phaser without torque, and then tighten the middle-mounted solenoid valve of the intake phaser and the middle-mounted solenoid valve of the exhaust phaser after the timing chain assembly, track fixing assembly and timing chain tensioner assembly are all installed. Tighten the center-mounted solenoid valve assembly to the torque specified in Table A.

### 3. Install crankshaft timing sprocket

When installing the crankshaft timing sprocket, one end with large chamfer on the hole edge and complete flange on the end face is installed inwards, and one end with flange tooth face is installed outwards.

### 4. Install timing chain assembly

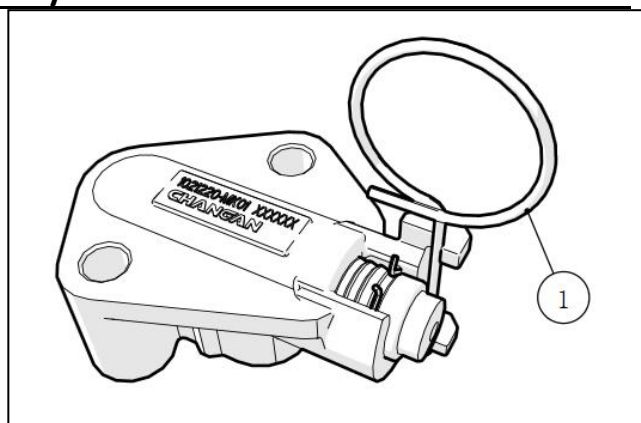
Before installing the timing chain, keep the special timing tooling to install and position the camshaft and flywheel to prevent rotation. Then hang the timing chain assembly on the correct position of intake and exhaust phaser and crankshaft timing sprocket.

### 5. Install movable rail assembly, fixed rail assembly and inter-axle guide rail assembly

Install timing chain rail fixing assembly, timing chain moving rail assembly and inter-axle guide rail assembly, tighten timing chain guide rail bolts, tighten according to the torque specified in Table A, and gently shake the moving rail assembly left and right to ensure normal movement.

### 6. Install timing chain tensioner assembly

Before the timing chain tensioner assembly is assembled, it is forbidden to pull out the tensioner lock pin. After the timing mechanism is assembled, check whether the timing chain assembly is in the guide groove of the movable rail assembly and fixed rail assembly, and then pull out the tensioner lock pin.



Project	Description
1	Tensioner pin

After the timing mechanism chain system is assembled, do not rotate the crankshaft in the reverse direction (counterclockwise).

### 7. Install front cover assembly

Before installing the engine front cover, press the crankshaft front oil seal assembly into the engine front cover oil seal hole with the oil seal pressing tool. The oil seal end face shall be parallel to the oil seal hole end face (not inclined). The oil seal concave hole end face shall be about 0.5 mm. The oil seal spring shall not be displaced or fall off. The sealant shall be uniformly applied to the corresponding cylinder block and cylinder head of the engine front cover. The coating path is shown in the figure.



**Note:** Ensure the front oil seal is clean during assembly. Do not touch the oil seal lip by hand. The oil seal outer diameter cannot be coated with sealant during assembly.

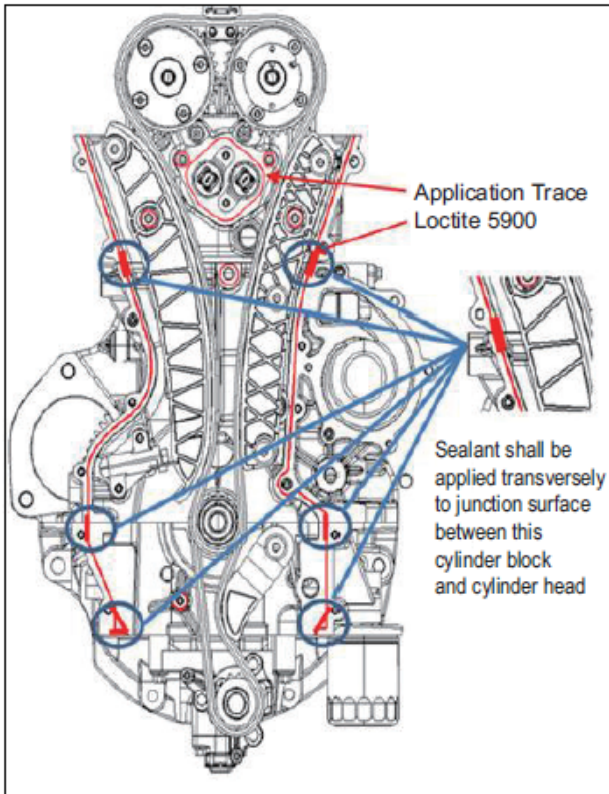
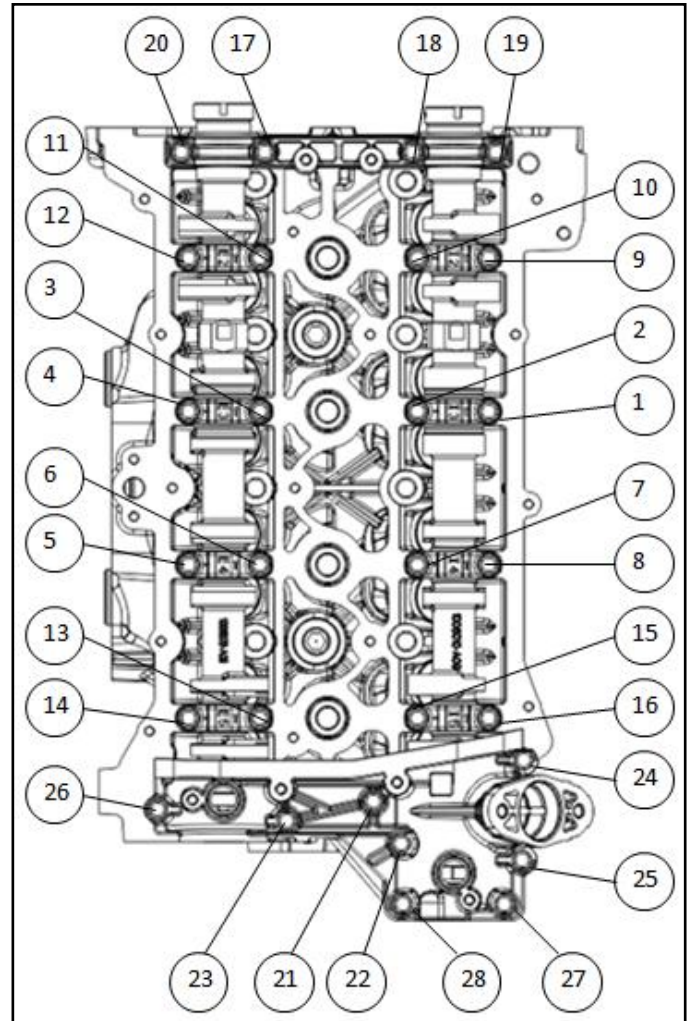


figure below.



8. Install right suspension bracket, oil pan assembly, etc.

9. Install the crankshaft torsional damper assembly. When assembling the crankshaft pulley combination bolt, ensure that the timing tooling secures the camshaft and flywheel at the correct timing phase position. Assembly shall be in accordance with the process specified in Appendix Table A.



**Note:** When tightening, the bolt shall be pre-tightened to  $(120 \pm 2)$  Nm, then rotated by  $(120 \pm 2)^\circ$ , and the angle shall be calculated from  $(120 \pm 2)$  Nm).



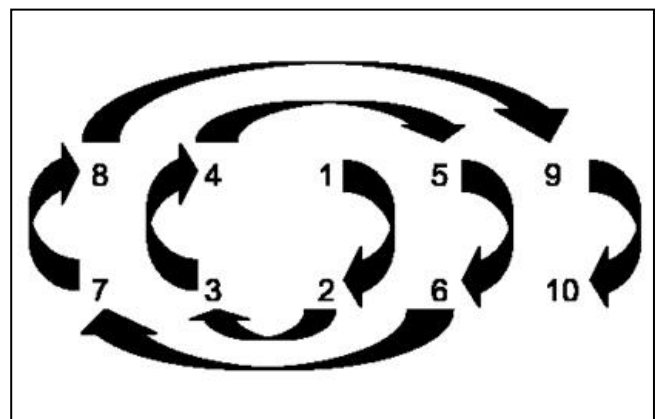
**Note:** Once removed, the cylinder gasket cannot be reused. When reassembling, always use a new cylinder head gasket assembly.

## Camshafts, valves and cylinder heads

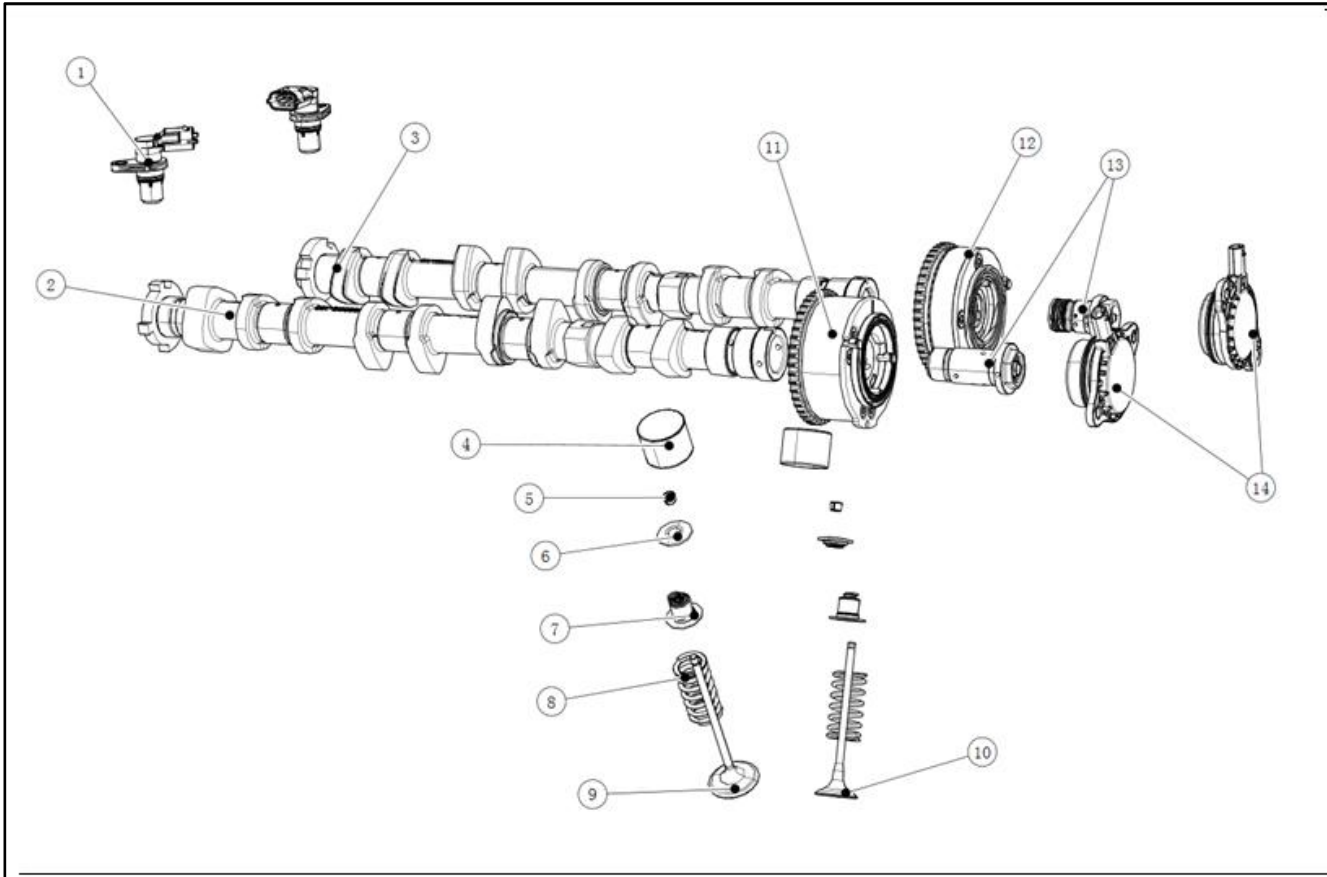
### Removal

1. Disconnect the positive and negative battery wires and remove the battery.
2. Drain coolant and engine oil.
3. Remove the front gear train, solenoid, engine front cover, cylinder cover, center-mounted solenoid valve assembly, timing mechanism and other peripheral parts to be removed.
4. Remove the engine 1-10 type camshaft cover, and loosen the bolts step by step according to the decreasing sequence of 28-1 shown in the

5. Remove intake and exhaust camshaft assembly and take out mechanical tappet.
6. When removing the cylinder head bolts, loosen the bolts step by step in the decreasing sequence from 10 to 1 shown in the figure below (from both ends to the middle).

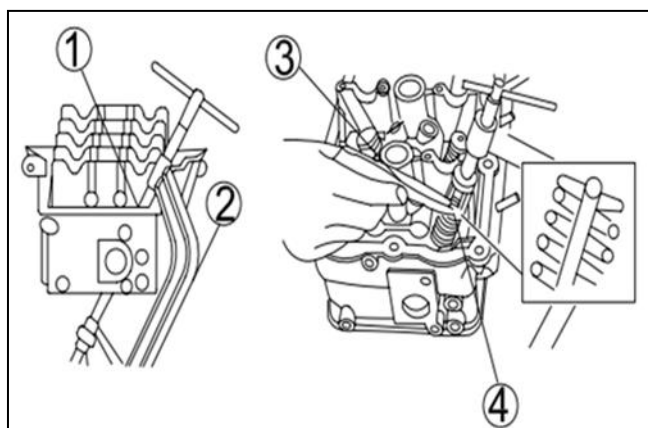


7. Remove the engine cylinder head assembly.  
sub-assembly and cylinder head gasket



Project	Description	Project	Description
1	Camshaft position sensor	8	Valve oil spring
2	Intake camshaft assembly	9	Intake valve
3	Exhaust camshaft assembly	10	Exhaust valve
4	Mechanical tappet	11	Intake phaser
5	Conical lock block	12	Exhaust phaser
6	Valve spring seat	13	Center-mounted solenoid valve assembly
7	Valve stem seal assembly	14	Center type electromagnet assy.

8. Use valve lifter to squeeze valve spring, then use tweezers  
子, Remove valve lock block.
9. Release valve lifter tool and remove spring seat and valve spring.
10. Remove the valve assembly from one side of the combustion chamber, and remove all valve spring, valve lock block, valve spring seat, valve and other valve components in sequence.
11. Remove the valve stem seal from the side of the valve guide using a special tool.



Project	Description
1	Valve spring seat
2	Special tool
3	Tweezers
4	Valve lock block



**Note:** Valve stem seal cannot be reused once removed. Always use a new valve stem seal during assembly.

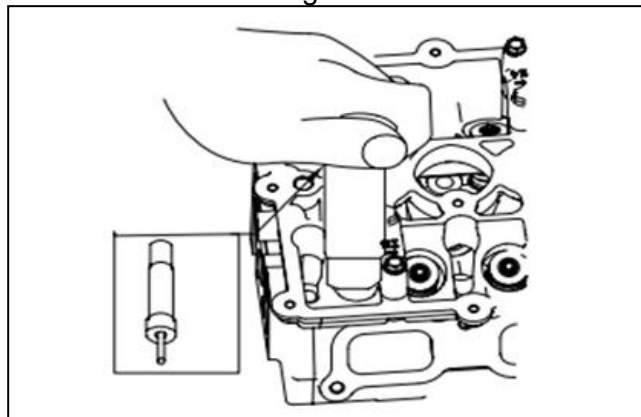
12. Position the removed valve assembly components in sequence so that they can be fitted in the original position.

## Installation

1. Valve mechanism assembly

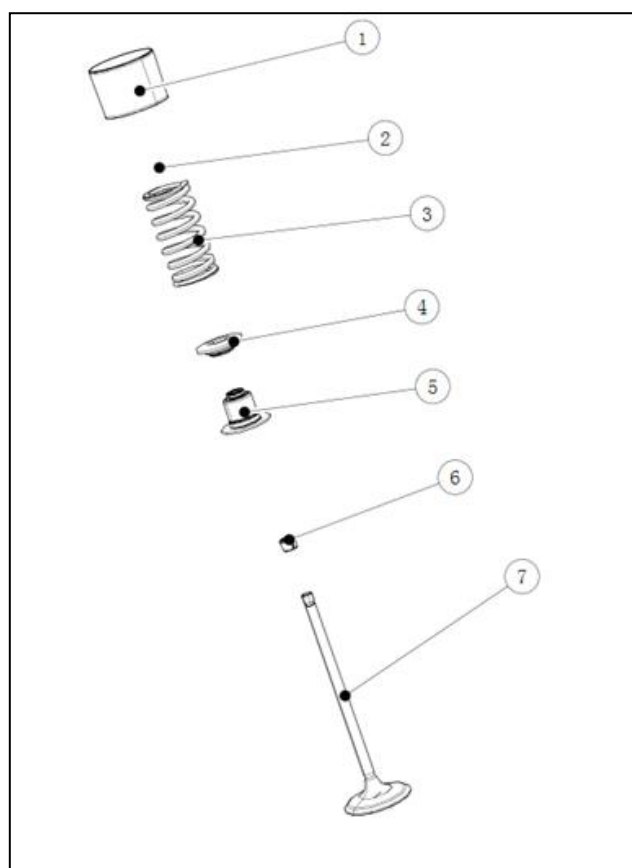
The valve spring seat inner hole shall be free of foreign matter, and the valve oil seal shall be assembled in place without deflection.

Apply gasoline engine oil on the special tool mandrel (the part in contact with the valve oil seal), press the valve oil seal into the valve guide tube and confirm it in place. The oil seal spring shall not displace or fall off during pressure installation, and the lip shall be intact and not be damaged.



When installing the valve, make sure that the 45° joint taper of the valve and valve seat is clean and free of foreign matter, and install the valve guide after applying gasoline engine oil on the valve stem and rod end.

The large pitch end painted with blue color mark on the valve spring shall be arranged above, and its small pitch end shall correctly fall into the seat hole and shall not be skewed.



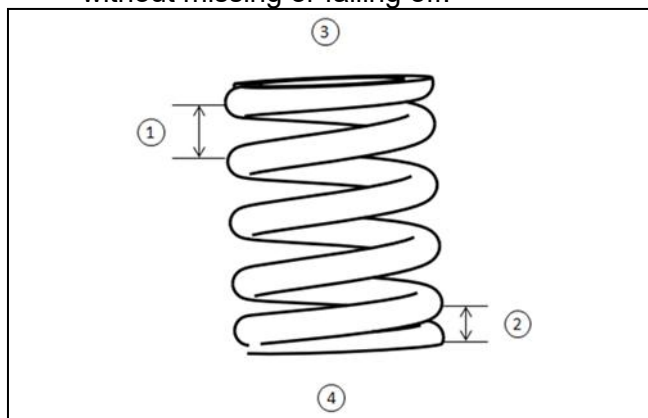


Project	Description
1	Mechanical tappet
2	Color code end of spring
3	Valve spring
4	Valve spring seat
5	Valve stem seal assembly
6	Valve lock block
7	Valve



Note: Never use a hammer or other things to knock the valve stem seal installation tooling when installing. When installing the valve stem seal onto the guide tube, just press the special tooling by hand.

The valve spring seat shall be seated in the spring, fix the valve with special equipment (valve lifter), press down the spring seat to install the valve cone lock block, and clamp it in the groove of the valve lock block correctly without missing or falling off.



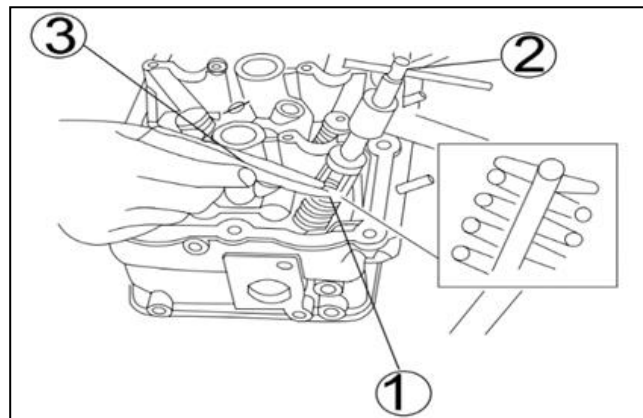
Project	Description
1	Large pitch
2	Small pitch
3	Valve spring seat side
4	Valve stem seal assembly side

## 2. Mechanical support installation

Install the corresponding tappet in the tappet hole according to the valve clearance.

## 3. Installation of cylinder head gasket

Once removed, the cylinder gasket cannot be used again. During installation, the new cylinder gasket must be used. The high-pressure oil hole of the cylinder gasket assembly should be aligned with the oil hole on the crankcase sub-assembly, and the "CHANGAN" mark should be facing upwards, not reversed.



Project	Description
1	Valve lock block
2	Valve lifter
3	Tweezers

## 4. Installation of cylinder head sub-assembly

Before installing the cylinder head sub-assembly, remove the 1 ~ 10 # camshaft cover, and rotate the crankshaft to make the four piston top surfaces basically at the same height. Clean the cylinder block cylinder head joint surface with cleaning agent, wipe it dry with a rag to ensure that there is no oil residue, apply glue Loctite 5900 to the position where the T-shaped area of the crankcase and the cylinder gasket fit the T-shaped area, and then install the cylinder head locating pin, cylinder gasket and cylinder head in turn and seat them in place. "Torque + angle method" shall be adopted for cylinder head combination bolts in reverse order of removal (increasing order from 1 to 10), tighten cylinder head connecting bolts according to process requirements specified in Appendix Table A, tighten them synchronously by tightening machine or tighten them symmetrically from middle to both sides by hand.

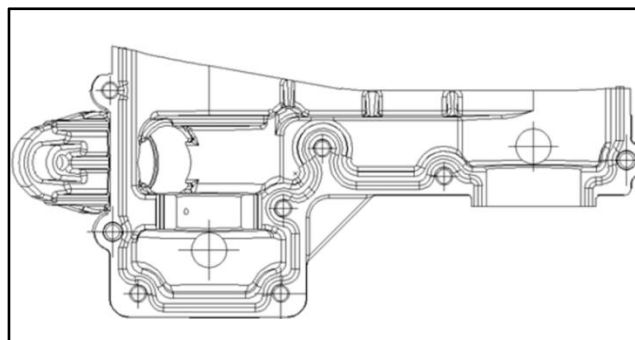


Note: Once the cylinder head connecting bolts are removed and cannot be reused, they must be replaced with new cylinder head connecting bolts.

## 5. Camshaft installation

- Camshaft, shaft hole, bearing cover and bearing seat joint surface shall be clean and free of foreign matter;
- Before placing the camshaft, apply gasoline engine oil on the cylinder head camshaft diameter and mechanical tappet installation position;
- After the camshaft is coated with gasoline engine oil, correctly install it on the bearing seat, install the locating pin, and do not touch or scratch all camshafts and mechanically prop up the working surface during the process of installing the camshaft;
- After placing the camshaft, apply gasoline engine oil to the diameter of the camshaft, then install the 1#-9# camshaft cover and tighten it symmetrically according to the sequence from the middle to both sides of the upper bolt or tighten it to the torque specified in Table A. The bolt tightening sequence is shown in the following figure.

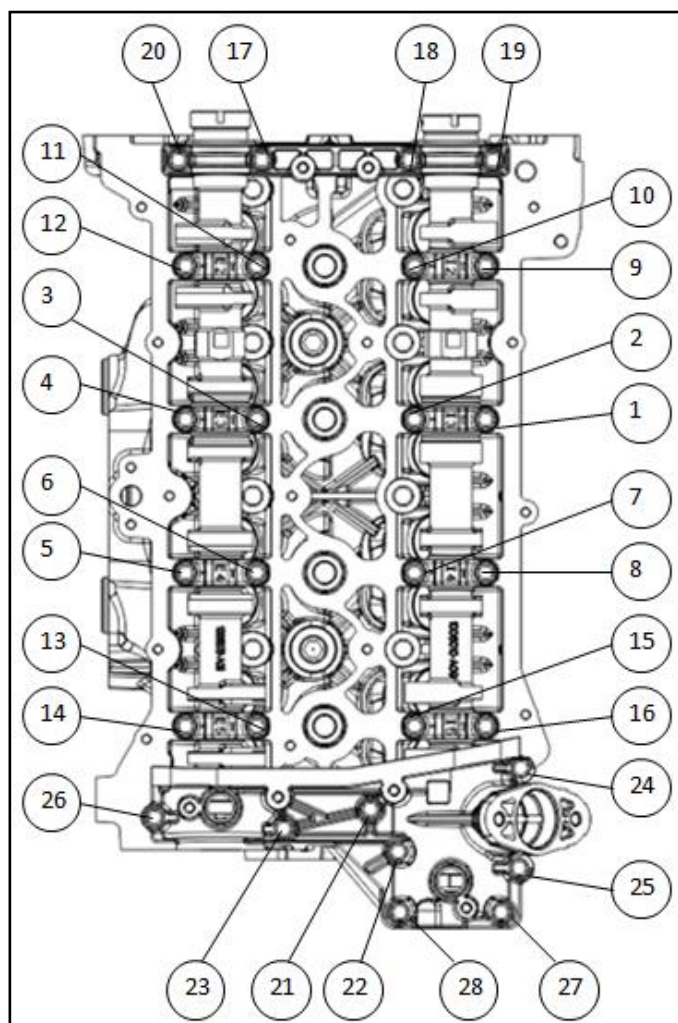
- Apply glue to the 10# camshaft cover according to the glue path shown in the figure, check that the glue is uniformly applied without broken belt, and ensure that the sealant is not adhered to the camshaft journal, oil hole and camshaft oil seal contact surface. If the sealant is adhered, remove the overflowing sealant and install it. The upper bolts are tightened symmetrically from the middle to both sides or tighten to the torque specified in Table A with a tightening machine.

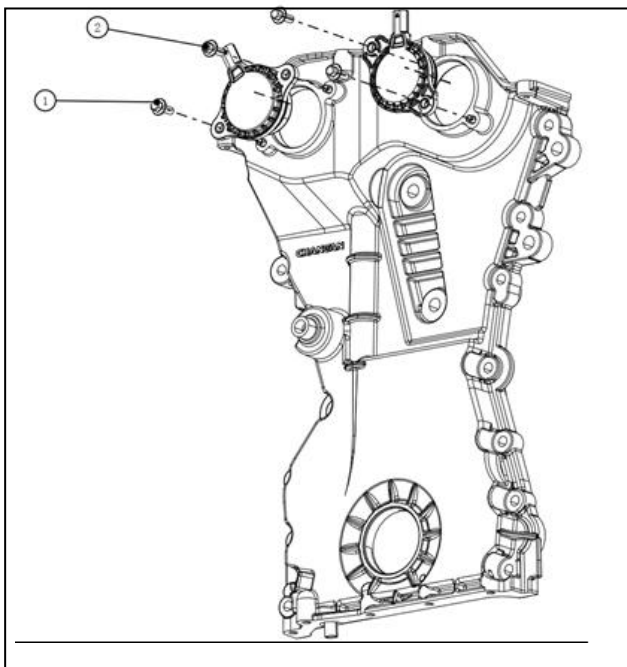


- Before assembling the camshaft until the chain is in place, do not rotate the crankshaft to prevent any cylinder piston from being at TDC to prevent the valve from colliding with the piston.

## 6. Installation of center-mounted electromagnetic assembly

Apply engine oil evenly on the O-ring surface of center-mounted electromagnetic assembly during installation, align the front cover electromagnetic assembly mounting hole, slowly push into the mounting hole, confirm the mounting surface is fully fitted, and then tighten the bolts according to the torque specified in Table A.





Project	Description
1	Connecting bolt between middle-mounted electromagnetic assembly and cylinder head
2	Center-mounted solenoid valve assembly

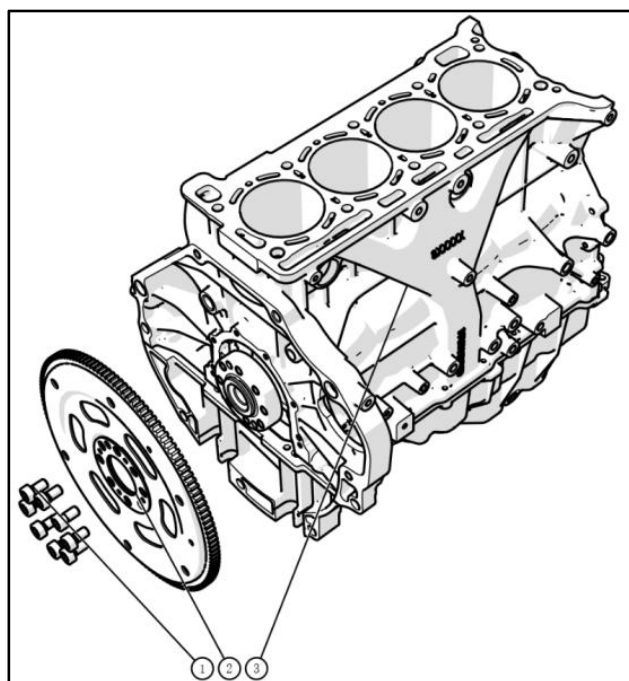
7. Install the engine timing mechanism and engine front cover as described above.
8. Install the engine spark plug assembly and cylinder head cover assembly as described above.
9. Install the engine oil pan assembly as described above.
10. Install engine thermostat assembly, electronic thermostat assembly, ignition coil assembly and engine front end gear train mechanism.
11. Install the intake and exhaust systems of the engine as described above.
12. Check to ensure that all removed parts have been installed back in place.
13. Refill the engine with engine oil.
14. The cooling system refills the coolant and drains the air from the system.
15. Connect negative wire of battery.
16. Check each joint for coolant and oil leaks.

17. Confirm the ignition timing is within the technical requirements.

## Main bearing shell, crankshaft and cylinder block

### Removal

1. Remove the engine assembly from the engine compartment as described above, rule out Engine coolant and oil.
2. Remove the starter motor and transmission assembly from the engine and remove the drive plate assembly as shown in the figure below:



Project	Description
1	Bolt
2	Drive disc assembly
3	Cylinder block



**Note:** When removing the bolts of drive disk assembly, it should be carried out according to diagonal loosening principle.

3. Remove the engine intake and exhaust system, oil pan and cylinder head cover assembly as described above.
4. Remove the engine timing system as described above.
5. Remove the cylinder head from the cylinder block as described above.

### 3.1.3 -46

### Mechanical system

### 3.1.3 -46

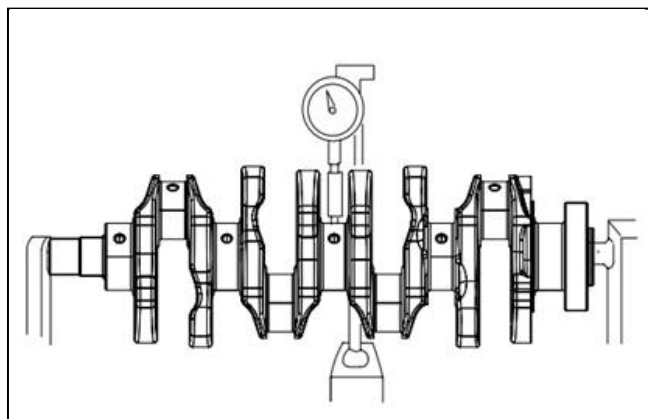
6. Remove the engine crank linkage as described above. Use a pencil or quick-dry paint to mark the cylinder number on all pistons, connecting rods and connecting rod bushings.
7. Remove the engine oil pump assembly as described above.
8. Loosen the main bearing cap connecting bolts symmetrically from both sides to the middle.
9. Remove the crankshaft thrust plate, take out the engine crankshaft assembly, and remove the upper and lower main bearing shells.

#### Cleaning

1. Clean removed upper and lower main bearing shells and crankshaft assembly and other parts.

#### Check

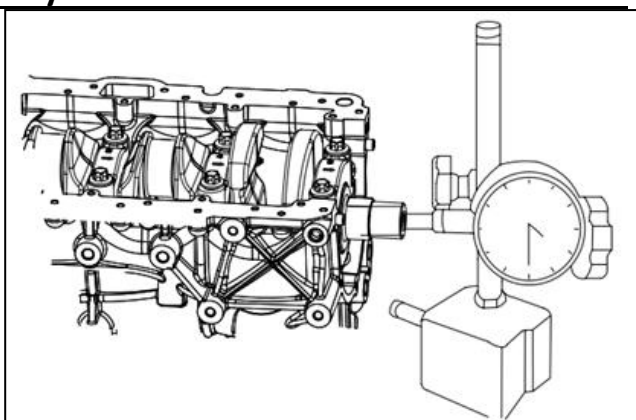
1. Crankshaft



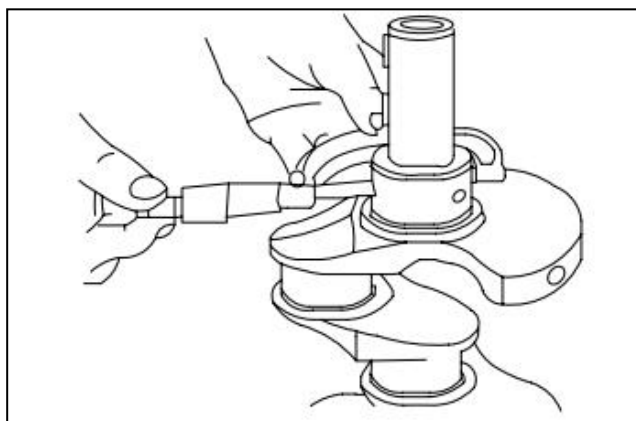
- Crankshaft thrust clearance:

Position the crankshaft in the cylinder block to measure the crankshaft thrust clearance according to the conventional method, that is, install the thrust plate and main bearing cover.

Read out the displacement in the axial (thrust) direction of the crankshaft with a dial indicator, and if the limit value is exceeded, replace the thrust plate with a new, standard thrust plate.



Name	Standard	Limit value
Crankshaft thrust clearance	0.06~0.26 mm	0.26m



2. Main bearing

Inspect the pitting corrosion, scratches, wear and damage of the main bearing shell surface. If any defects are found, replace the upper and lower main bearing shells at the same time. Never replace only half of the bearing shell.

3. Main bearing shell clearance

Check bearing shell clearance with a plastic plug gauge according to the following procedure.

- Remove main bearing cover.
- Clean bearing shells and main journal.
- Place a plastic plug gauge of full bearing width (parallel to the crankshaft) on the main journal to avoid the oil hole.
- Install the main bearing cap according to the above schematic diagram, and tighten the bolts evenly to the specified torque.

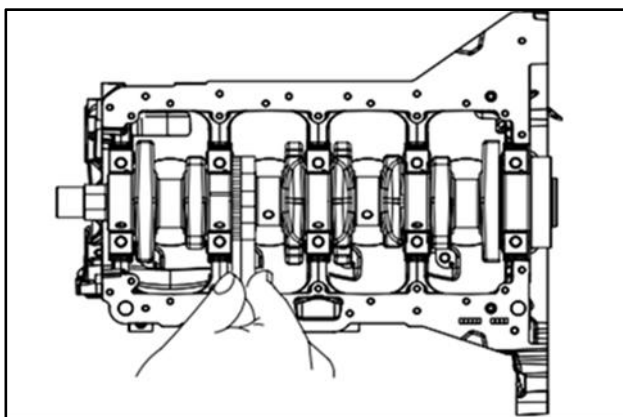


Note: To ensure correct reading of clearance,



the main bearing cap must be tightened to the required tightening torque. Do not rotate the crankshaft when fitting the plastic plug gauge.

- Remove the main bearing cap, measure its width at the widest point of the plastic plug gauge with a gauge, and replace the main bearing shell if the clearance exceeds its limit value. Always replace the upper and lower main bearing shells as a whole. Never replace only half of the bearing shells.



- A new standard bearing shell may produce the correct clearance. If the correct clearance cannot be generated, it is necessary to

re-grind the crankshaft journal with a bearing shell with a dimension of 0.25 mm.

- After selecting new upper and lower main bearing shells, re-check bearing shell clearance.

#### 4. Selection of main bearing shell

Standard bearing shell: If the bearing shell is incorrect or the bearing shell clearance exceeds the technical requirements, select a new standard bearing shell according to the following procedure and install it.

- The first, second, third, fourth and fifth (left to right) numbers printed on the cylinder block represent the crankshaft bore diameters of the main bearing caps "1," "2," "3," "4" and "5" respectively.
- Crankshaft holes are divided into 1, 2 and 3 groups, and (1, 2 and 3 groups) respectively represent the following main bearing hole diameters.

There are five standard bearing shells, which vary in thickness. In order to distinguish them, "1," "2" and "3" marks are printed on the steel back of the bearing shell, and the bearing shell thickness and matching relationship are carried out according to the following table.

**Table A2 Group Fit Table Of Dimensions Of Crankshaft Main Journal, Main Bearing Hole And Main Bearing Bush mm**

Fit clearance 0.024~0.052				Crankshaft main journal diameter group					
				1		2		3	
				Grouping mark					
				1		2		3	
Crankshaft spindle bore grouping mark	Group	Marking	Grouping size range	$\Phi 54 \begin{smallmatrix} 0 \\ -0.016 \end{smallmatrix}$		$\Phi 54 \begin{smallmatrix} -0.0161 \\ -0.022 \end{smallmatrix}$		$\Phi 54 \begin{smallmatrix} -0.022 \\ -0.028 \end{smallmatrix} 1$	
	1	1	$\Phi 58 \begin{smallmatrix} +0.006 \\ 0 \end{smallmatrix}$	3	$2.0 \begin{smallmatrix} -0.007 \\ -0.011 \end{smallmatrix}$	3	$2.0 \begin{smallmatrix} -0.007 \\ -0.011 \end{smallmatrix}$	2	$2.0 \begin{smallmatrix} -0.003 \\ -0.007 \end{smallmatrix}$
	2	2	$\Phi 58 \begin{smallmatrix} +0.012 \\ +0.006 \end{smallmatrix}$	3	$2.0 \begin{smallmatrix} -0.007 \\ -0.011 \end{smallmatrix}$	2	$2.0 \begin{smallmatrix} -0.003 \\ -0.007 \end{smallmatrix}$	1	$2.0 \begin{smallmatrix} +0.001 \\ -0.003 \end{smallmatrix}$
	3	3	$\Phi 58 \begin{smallmatrix} +0.018 \\ +0.012 \end{smallmatrix}$	2	$2.0 \begin{smallmatrix} -0.003 \\ -0.007 \end{smallmatrix}$	1	$2.0 \begin{smallmatrix} +0.001 \\ -0.003 \end{smallmatrix}$	1	$2.0 \begin{smallmatrix} +0.001 \\ -0.003 \end{smallmatrix}$

- Using a plastic plug gauge, check the bearing shell clearance of the newly selected standard bearing shell. If the clearance still exceeds its limit value, use the next thicker bearing shell and check the clearance again.
- When replacing the crankshaft or cylinder block, refer to the number printed on the new crankshaft or the letter printed on the mating surface of the new cylinder block to select the new standard bearing shell to be installed.

#### 5. Selection of connecting rod bush

- Check the grouping number of fan plate connecting rod journal: For example, 2223;
- Check the grouping number of big end hole diameter of connecting rod: For example, 2222;
- Select connecting rod bushing according to the following table, and the corresponding connecting rod bushing grouping number is 2221;

**Table A3 Group Fit Table Of Crankshaft Connecting Rod Journal, Connecting Rod Big Hole And Connecting Rod Bearing Shell Size mm**

Fit clearance 0.020~0.048				Crankshaft connecting rod journal diameter group					
				1		2		3	
				Grouping mark					
				1		2		3	
Conn ecting rod bore	Grou p	Mark ing	Grouping size range	$\Phi 48 \begin{smallmatrix} 0 \\ -0.00\epsilon \end{smallmatrix}$		$\Phi 48 \begin{smallmatrix} -0.0061 \\ -0.012 \end{smallmatrix}$		$\Phi 48 \begin{smallmatrix} -0.0121 \\ -0.018 \end{smallmatrix}$	
	1	1	$\Phi 51 \begin{smallmatrix} +0.006 \\ 0 \end{smallmatrix}$	3	$1.5 \begin{smallmatrix} -0.010 \\ -0.014 \end{smallmatrix}$	3	$1.5 \begin{smallmatrix} -0.010 \\ -0.014 \end{smallmatrix}$	2	$1.5 \begin{smallmatrix} -0.006 \\ -0.010 \end{smallmatrix}$
	2	2	$\Phi 51 \begin{smallmatrix} +0.012 \\ +0.0061 \end{smallmatrix}$	3	$1.5 \begin{smallmatrix} -0.010 \\ -0.014 \end{smallmatrix}$	2	$1.5 \begin{smallmatrix} -0.006 \\ -0.010 \end{smallmatrix}$	1	$1.5 \begin{smallmatrix} -0.002 \\ -0.00\epsilon \end{smallmatrix}$
	3	3	$\Phi 51 \begin{smallmatrix} +0.018 \\ +0.0121 \end{smallmatrix}$	2	$1.5 \begin{smallmatrix} -0.006 \\ -0.010 \end{smallmatrix}$	1	$1.5 \begin{smallmatrix} -0.002 \\ -0.00\epsilon \end{smallmatrix}$	1	$1.5 \begin{smallmatrix} -0.002 \\ -0.00\epsilon \end{smallmatrix}$

- The clearance of connecting rod bearing shell is shown in the following table (see next page);

Fit clearance 0.020~0.048		Crankshaft connecting rod journal diameter group		
		1	2	3

				Grouping mark		
				1	2	3
Connecting rod bore	Group	Marking	Grouping size range	Clearance		
	1	1	$\Phi 51_{-0}^{+0.006}$	0.020~0.040	0.0262~0.046	0.0241~0.044
	2	2	$\Phi 51_{+0.0061}^{+0.012}$	0.0261~0.046	0.0242~0.044	0.0222~0.042
	3	3	$\Phi 51_{+0.0121}^{+0.018}$	0.0241~0.044	0.0222~0.042	0.0282~0.048

- Use plastic plug gauge to check the clearance between big end of connecting rod and crankshaft shaft handle plate. The clearance value shall be 0.10~0.30 mm.

#### 6. Crankshaft rear oil seal

- The crankshaft rear oil seal cannot be reused after dismantling. It needs to be replaced with a new oil seal. Before installing the oil seal, check the crankshaft of the crankshaft chamfering machine for scratches, burrs and other defects. If necessary, handle or replace the crankshaft.
- During the installation of crankshaft rear oil seal, special tooling shall be used to press in smoothly to ensure that the end surface of oil seal is parallel to the end surface of rear oil seal hole, the recess shall be no more than 0.5 mm, the oil seal spring shall not be displaced or fall off, and the oil seal after installation shall be flat and not inclined. After assembly, the crankshaft shall be rotated flexibly without jamming, and then the crankshaft axial clearance shall be detected, and the clearance shall be between 0.06 mm~0.26 mm.



Note: Ensure the rear oil seal of crankshaft is clean during assembly. Do not touch the oil seal lip by hand. The oil seal outer diameter cannot be coated with sealant during assembly.

#### 7. Drive plate

If the drive disk is damaged, broken or worn, replace the drive disk assembly.

Drive disc description:

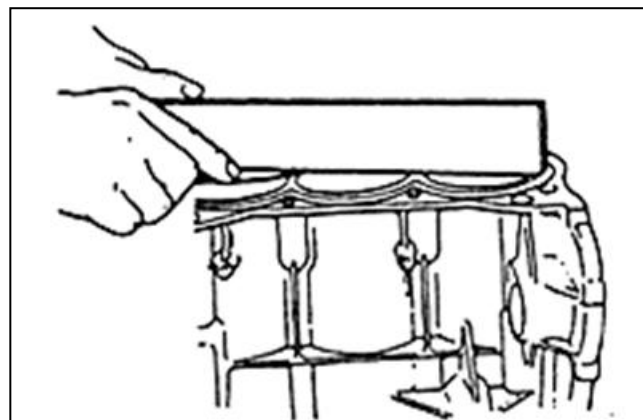
D20TG-AA drive plate (also called flexible plate) consists of reinforced plate, ring gear and disc body. The reinforced plate is riveted to the disc body, and the ring gear is welded to the disc body. It is

supplied by the assembly and assembled on the engine crankshaft. Then it is connected with the hydraulic torque converter (transmission) through six bolts to complete power transmission from the engine to the transmission. At the same time (ring gear) is matched with the starter motor to complete vehicle starting.

#### 8. Cylinder block sealing surface deformation

Check the deformation of the sealing surface with a straight edge and thickness gauge. If the flatness exceeds its limit value, trim the cylinder body flatness.

Name	Standard	Limit value
Flatness	0.03mm	0.05mm

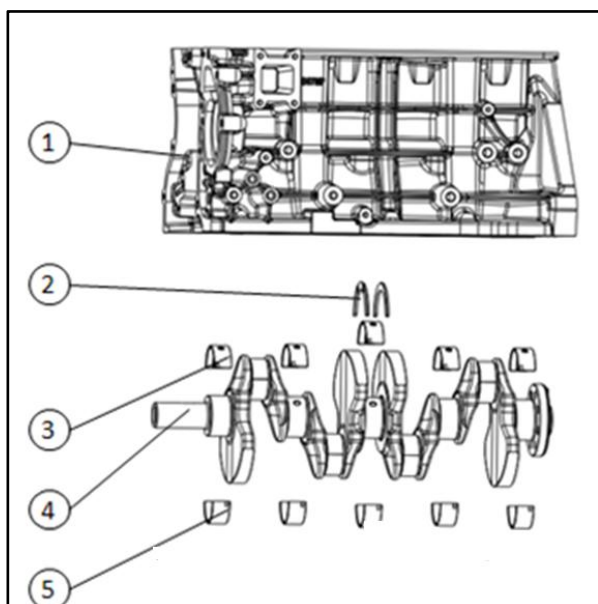
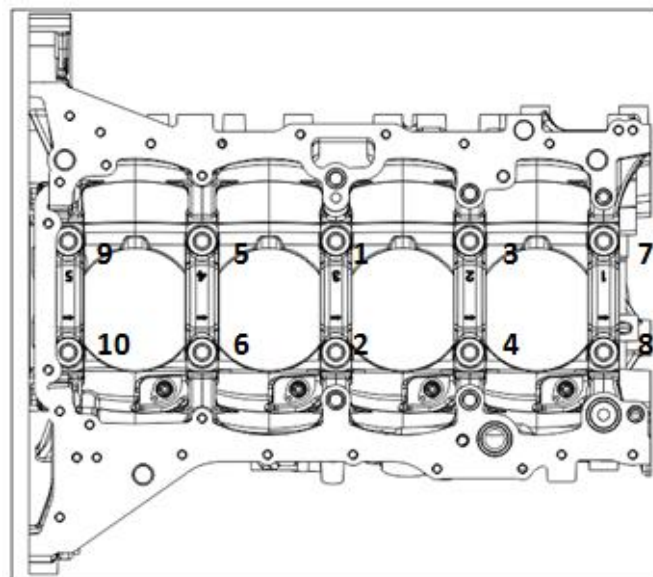


#### Installation

1. Install crankshaft assembly and crankshaft thrust plate.

- As described above, the upper and lower main bearing bushings are optional. No confusion is allowed.

- Apply gasoline engine oil on the joint surface of each main bearing shell and crankshaft and the main journal surface of crankshaft; the upper main bearing shell (with oil hole) is installed in the crankcase bearing seat; the lower main bearing shell (without oil hole) is installed in the crankcase bearing seat; the upper and lower main bearing shells are not allowed to be installed inversely or incorrectly; the back of the bearing shell is closely fitted to the surface of the bearing seat hole, and the end surface is flush with the joint surface of the crankcase and the bearing seat.
- Keep the crankcase clean and free of metal chips and other foreign matters. Install the crankshaft and thrust plate into the upper body of the crankcase. The oil groove on the crankshaft thrust plate should face the crankshaft crank arm.



Project	Description
1	Crankcase assembly
2	Thrust plate
3	Upper main bearing shell
4	Crankshaft
5	Lower main bearing shell

- The main bearing cap bolts shall be tightened according to the torque specified in Appendix Table A by "Torque + Angle Method" in the sequence shown in the following figure (1 to 10 increasing sequence), or by a tightening machine at the same time.



Note: Once the main bearing cap bolts are removed and cannot be reused, they must be replaced with new ones.

2. Install the piston, connecting rod assembly and engine cylinder head sub-assembly as described above.
3. Install the engine timing system and front gear train as described above.
4. Install the oil pan assembly and cylinder head cover assembly as described above.
5. Install intake and exhaust system, starter motor and drive disk assembly as described above.



Note: Drive disk bolts have sealant (blue). Make sure sealant is not broken continuously before assembly.



Note: Drive disk bolts can only be used once. Once removed, they must be replaced with new self-adhesive bolts. Before assembly, clean the residual adhesive in the mounting hole.

6. Install engine transmission assembly.
7. Check to ensure that all removed components are reinstalled in the original location and that no reinstalled components are reinstalled.
8. Refill the engine with oil according to the "Engine oil change" clause.
9. Refill the engine coolant and drain the air from the system.
10. Connect the negative wire of the battery

### 3.1.3 -51

### Mechanical system

### 3.1.3 -51

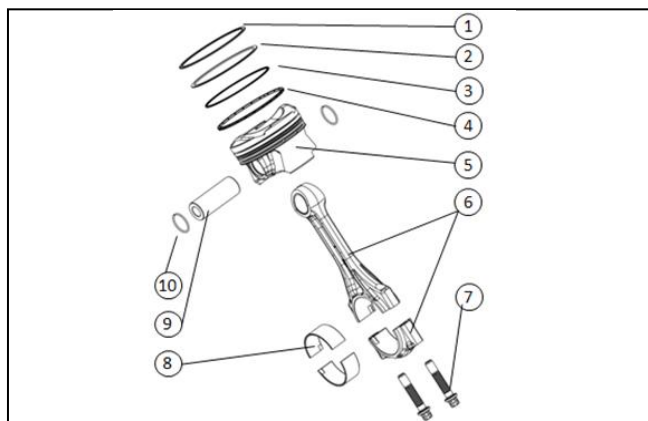
(battery).

11. Verify all joints are free of gasoline, coolant, oil and air leakage.

## Pistons, piston rings, connecting rods and connecting rods

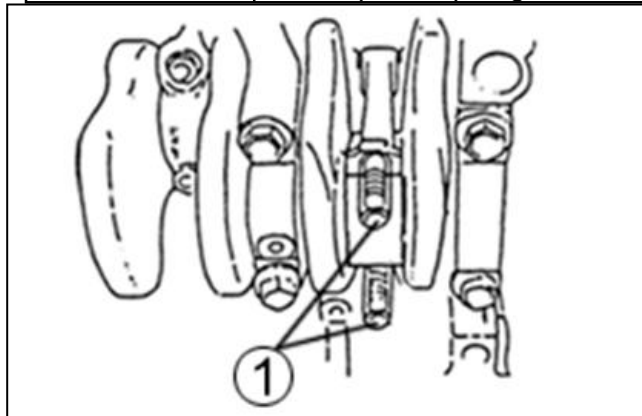
### Removal

1. Disconnect negative battery wire.
2. Drain engine coolant and gasoline engine oil.
3. Remove intake and exhaust system, oil pan and timing system as described above.
4. Remove the cylinder head from the cylinder block as described above.
5. Use a pencil or quick-dry paint to mark the cylinder number on all pistons, connecting rods and connecting rod bushings.
6. Remove connecting rod shell cover.
7. Install rubber sleeve on the threads of connecting rod bolts in order to avoid damaging the threads of journal bearing, cylinder bore and connecting rod bolts when removing the connecting rod.



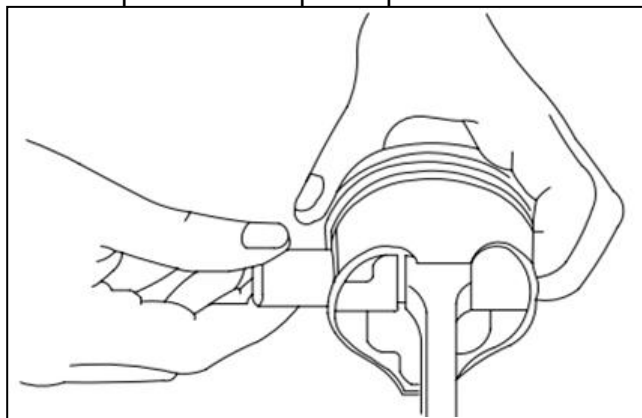
Project	Description
1	Gas ring
2	Scraper ring
3	Wiper blade
4	Lining ring
5	Piston
6	Connecting rod assembly

7	Connecting rod bolt
8	Connecting rod bearing shell
9	Piston pin
10	Piston pin snap ring



Project	Description
1	Rubber sheath

8. Remove carbon deposits at the upper end of the cylinder liner before removing the piston from the cylinder.
9. Push the piston and connecting rod out of the upper end of the cylinder bore, and place them accurately according to the cylinder number of the cylinder bore for subsequent installation.
10. Using the piston ring expander, remove the gas ring, scraper ring, scraper blade and lining ring from the piston.
11. Carefully loosen the piston pin circlip as shown and press out the piston pin at the same time.



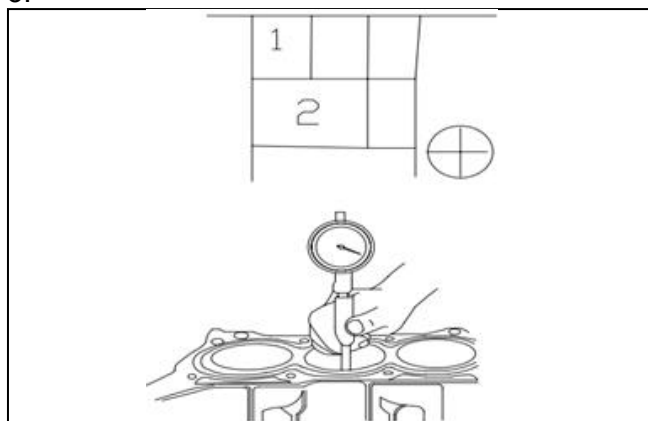
### Cleaning

Clean the carbon deposit, grease and sealant on the piston head, ring groove, piston ring and cylinder block with metal cleaning agent and proper

tools.

1. Observe whether the cylinder wall has deep scratches or uneven convex and concave. If yes, replace the cylinder block.
2. As shown in the figure, measure the cylinder in two directions (intake and exhaust side A direction, front and rear end B direction) and three positions (6.4 mm, 57.2 mm, 108 mm from the top surface of the cylinder block) with an inner diameter dial indicator. Replace the cylinder block if the following dimensions are out of tolerance.

3.



- Cylinder bore diameter out of tolerance.

- The roundness or cylindricity measurement difference between the two positions is out of tolerance.

- The thrust and axial measurement difference exceeds the roundness range.

Cylinder bore diameter limit:  $\Phi 86.014$  mm;

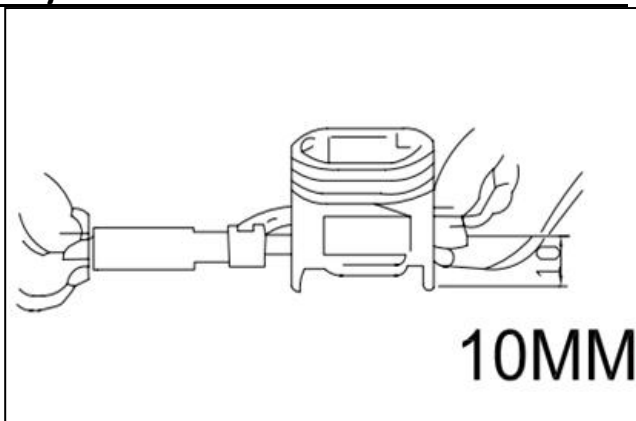
Roundness limit: 0.008 mm;

Cylindricity limit: 0.01 mm;

## Check

### Piston

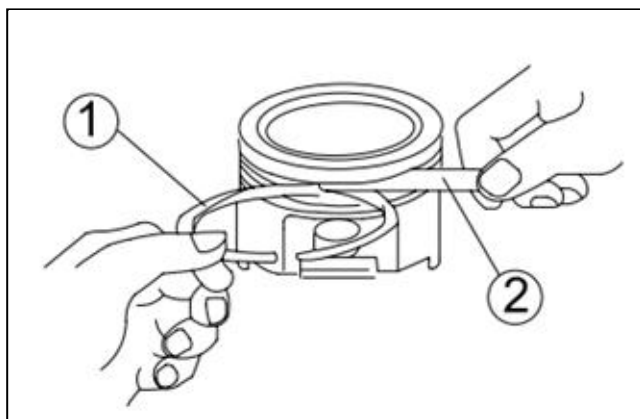
1. Check piston Whether there is wear, crack or other damage. If there is damage or fault, replace the piston.
2. Piston diameter:  
As shown in the figure, the diameter of the piston shall be measured at 12.5 mm (without printed graphite) from the end of the piston skirt to the vertical direction of the piston pin.



Piston diameter	Stand ard	$\Phi 85.960-\Phi 85.970\text{mm}$
Piston pin hole diameter	Stand ard	$\Phi 22.006-\Phi 22.010\text{mm}$

4. Piston clearance:

Piston clearance is the difference between cylinder diameter and piston diameter. The piston clearance should be within the following specifications. If it is out of tolerance, check the cylinder bore diameter or piston diameter, and replace the corresponding out of tolerance parts.



Project	Description
1	Piston ring
2	Feeler gauge

Piston clearance: 0.030-0.054 mm (Front of graphite printed on piston skirt)

5. Piston ring groove clearance:

Before inspection, the piston ring groove must be clean, dry and carbon-free. Install piston



ring in ring groove, and measure the clearance between ring and ring groove with thickness gauge; If the clearance is out of tolerance, replace the piston ring groove width and piston ring height dimension, and replace the corresponding out of tolerance parts.

Piston ring groove side clearance:

First ring: 0.03-0.08 mm; Second ring: 0.03-0.07 mm

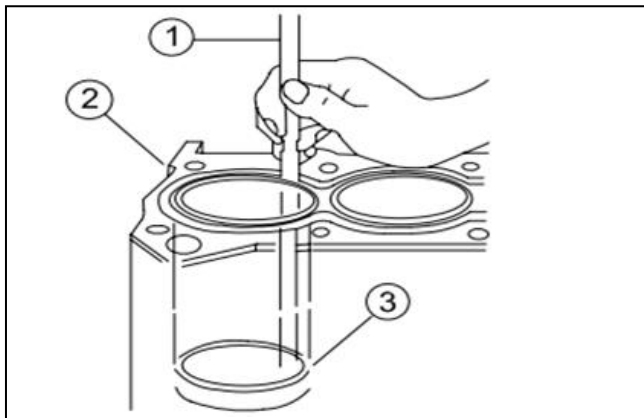
### Piston ring

1. Measure the piston ring end opening clearance, insert the piston ring into the cylinder, and measure the clearance with a thickness gauge. If the clearance is out of tolerance, replace the piston ring.



**Note:** The carbon deposit on the top of the cylinder must be cleaned before inserting the piston ring into the cylinder bore.

Project		Standard	Limit
Piston ring working clearance(Install the cylinder bore)	First ring	0.12-0.22mm	0.22mm
	Second ring	0.26-0.40mm	0.40mm



Project	Description
1	Clearance gauge
2	Cylinder block
3	Piston ring

### Piston pin

1. Inspect the piston pin, connecting rod small end hole and piston pin hole for wear or

damage. If the piston pin, connecting rod small end hole or piston pin hole is severely worn and damaged, replace the piston pin, connecting rod or piston.

2. Piston pin clearance:

Check the clearance between the piston pin and the small end of the connecting rod at the small end, if the small end hole of the connecting rod and the piston pin are seriously worn or damaged; If the clearance value is out of tolerance, replace the connecting rod or piston pin.

Diameter of small end hole of connecting rod:  $\Phi 22.006\text{--}\Phi 22.013\text{ mm}$

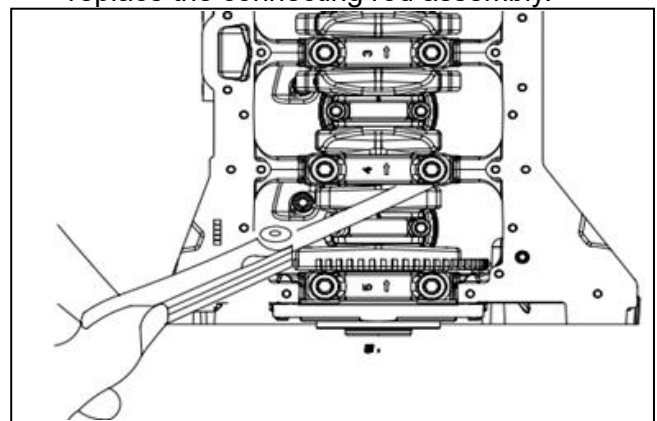
Piston pin diameter:  $\Phi 21.995\text{--}\Phi 22\text{ mm}$

Project	Description
Clearance between small end hole of connecting rod and piston pin	0.006-0.018mm
Clearance between piston pin hole and piston pin	0.006-0.015mm

### Connecting rod assembly

1. Large end side clearance:

Under normal state, connect the big end of connecting rod with the crank pin, check the side clearance of big end of connecting rod. If the measured clearance is out of tolerance, replace the connecting rod assembly.



Project	Standard	Limit
Large end side clearance	0.10-0.30mm	0.30mm

## 2. Connecting rod alignment:

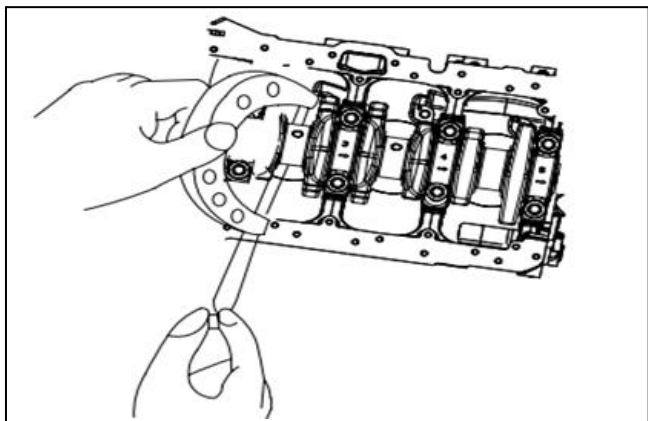
Install the removed connecting rod assembly on the connecting rod straightener, check whether it is bent or twisted, and replace if it is out of tolerance.

Bending limit: 0.04 mm/80 mm Twisting limit: 0.08 mm/80 mm

## Crank pin and connecting rod bearing shell

1. Inspect the crankpin for irregular wear or damage. Measure the out-of-roundness or taper straightness of the crank pin with a micrometer. If the crank pin is damaged, or out-of-roundness and taper straightness are out of tolerance, replace the crankshaft.

Crank pin roundness and straightness limit: 0.005 mm.



Connecting rod bearing shell model	Crank pin diameter
Standard size	Φ47.982-φ48.000mm

## 2. Connecting rod bearing shell:

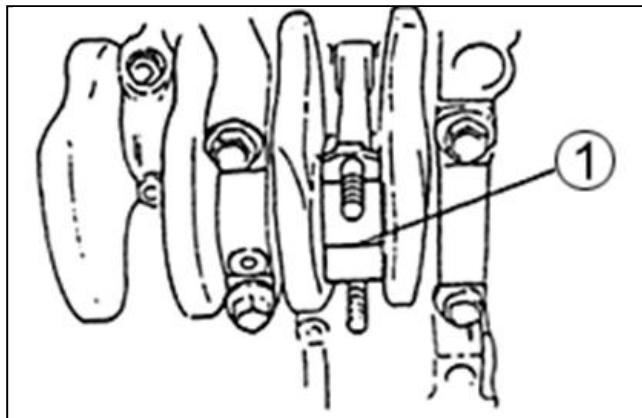
Check the bearing shell for melting, pit, ablation or surface peeling, and observe the contact shape. If the connecting rod bearing bush is obvious above, the connecting rod bearing bush must be replaced.

## 3. Connecting rod bearing shell clearance:

- Before checking bearing shell clearance, clean the removed connecting rod bearing shell and crank pin.
- Fit connecting rod bearing shell on connecting

rod and bearing cap.

- When connecting with the bearing bush, place a piece of plastic plug parallel to the crankshaft axis on the full-width crank pin to avoid the oil hole, as shown in the figure below.



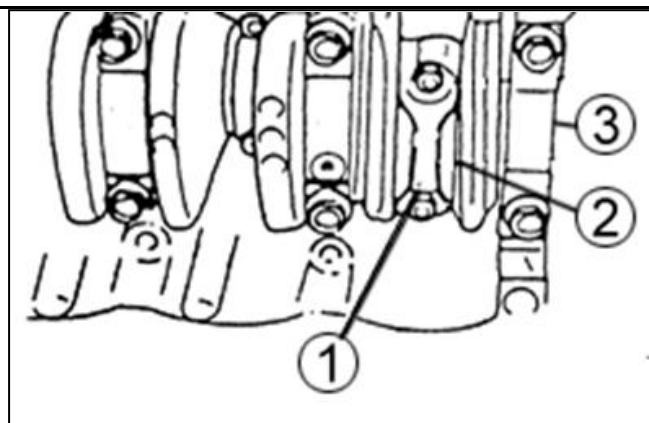
- When installing the connecting rod cap, the boss of the connecting rod cap shall point to the front end of the engine in the direction of the piston top arrow. Tighten the connecting rod bolts according to Appendix Table A. Before tightening, all bolts shall be pre-tightened to  $(30 \pm 2)$  Nm, then rotated by  $(90 \pm 2)^\circ$ . And the angle shall be calculated from  $(30 \pm 2)$  Nm.



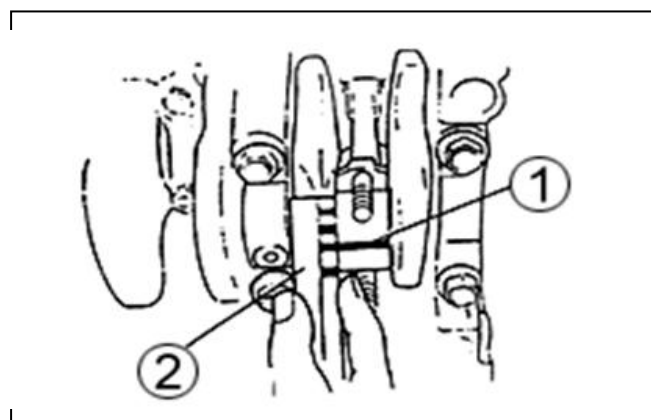
**Note:** Once the connecting rod bolts are removed and cannot be reused, they must be replaced with new connecting rod cap bolts.

- Remove the tile cover, place the ruler on the surface of the plastic plug gauge, and measure the width of the plastic plug gauge at the widest point of the gap. If the clearance is out of tolerance, use a new standard size bearing shell and measure the clearance again.
- If a new standard bearing shell is used and the clearance is still out of range, replace the crankshaft.





Project	Description
1	Connecting rod bearing shell cover
2	Connecting rod big end boss
3	Front end of engine



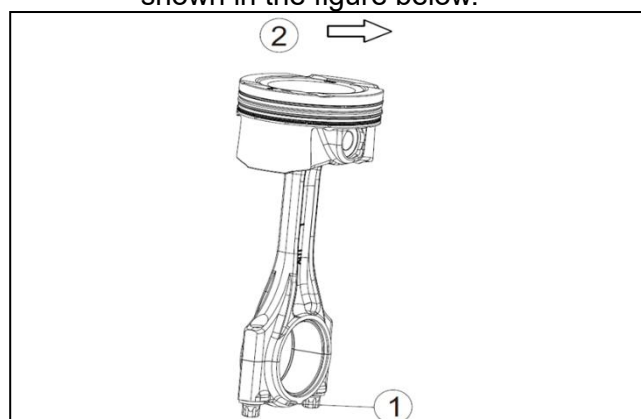
Project	Description
1	Plastic plug gauge
2	Gauge

## Installation

### 1. Install piston and piston ring

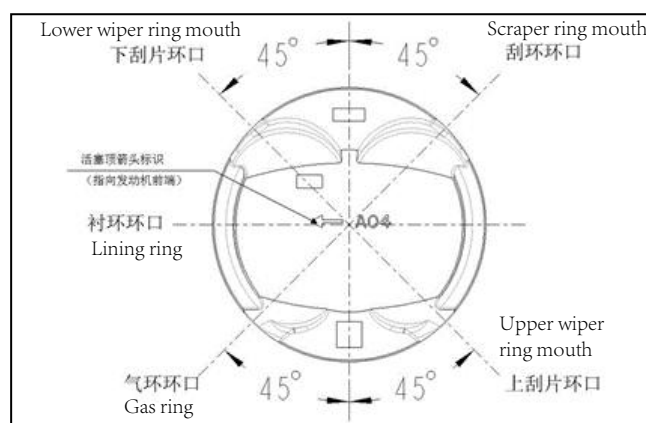
- Piston and cylinder bore assembly are not grouped; Connecting rod bearing bushings shall be selected according to size grouping marks in Table A3. The fitting clearance shall be 0.020~0.048 mm and shall be installed into the corresponding connecting rod body and connecting rod cap. The fitting shall be good.
- Install the piston ring, and the piston ring shall be installed according to the following requirements:

- Install the gas ring and scraper ring into the corresponding ring groove of piston, and assemble the marked surface toward the piston top surface;
- The opening of liner ring in steel strip combination oil ring shall be butted and not overlapped, and the wiper blade shall not be missed during assembly.
- The opening position of piston ring is shown in the figure below.



Project	Description
1	Boss
2	Piston crown arrow direction

- The connecting rod assemblies assembled on the same gasoline engine shall be the same mass group, and the mass difference between any two groups of piston connecting rod assemblies shall not be greater than 7g.



**Note:** When installing the piston pin snap ring, ensure that it is located in the snap ring groove, and the snap ring opening direction should point to the piston top surface at the same time.

- The connecting rod cap shall be matched with the connecting rod body of the same cylinder

number before removal, and the boss of the big end of the connecting rod shall be consistent with the direction of the piston top arrow during installation, both of which point to the front end of the gasoline engine.

- Coat the connecting rod bolt threads with gasoline engine oil, and tighten the bolts according to the torque specified in Appendix Table A by "torque + angle method." Tighten the bolts according to the sequence of cylinders 1, 4, 2 and 3 or tighten the bolts with a tightening machine at the same time.



**Note:** Once the connecting rod bolts are removed, they cannot be reused, and must be replaced with new connecting rod cap bolts.

- After installation, the rotational torque of the crankshaft shall not be greater than 10N.m, and the rotation shall be smooth without stagnation.
2. Install in the reverse removal procedure as previously described.
  3. Check to ensure that all removed components are reinstalled in the original location and that no reinstalled components are reinstalled.
  4. Refill the engine with oil according to the "Engine oil change" clause.
  5. Refill the engine coolant and drain the air from the system.
  6. Connect the negative wire of the battery (battery).
  7. Verify all joints are free of gasoline, coolant, oil and air leakage.
  8. Verify ignition timing is within technical parameters

## Precautions

### The following parts must be replaced when reassembling

Project	Description	Project	Description
1	Gasket	20	Water pump support gasket
2	Upper main bearing shell	21	Water inlet pipe gasket
3	Lower main bearing shell	22	Water outlet pipe O-ring
4	Crankshaft rear end cover assembly	23	Thermostat seat sealing ring
5	Front cover assembly	24	Overflow trachea gasket
6	Crankshaft pulley combination bolt	25	Oil pump outlet O-ring
7	Signal plate screw	26	Oil cooler sealing ring
8	Connecting rod bolt	27	Oil cooler gasket
9	Camshaft bearing cover bolt	28	Oil cooler gasket
10	Camshaft No. 6 bearing cap bolt	29	Cylinder head and supercharger gasket assembly
11	Cylinder head cover gasket	30	Supercharger intake connecting pipe gasket
12	Piston pin snap ring	31	Supercharger oil inlet pipe gasket
13	Connecting rod bearing shell	32	Supercharger oil return pipe gasket
14	Connecting rod bearing shell	33	Supercharger oil return pipe gasket
15	Drive plate bolt	34	Supercharger inlet and return water pipe gasket
16	Cylinder gasket assembly	35	Supercharger connecting stud
17	Cylinder head connecting combination bolt	36	Engine oil pressure sensor assembly
18	Valve stem seal assembly	37	High-pressure oil pump oil outlet pipe assy.
19	Valve tappet		

Note: Screw plugs and plugs are not dismantled. If they are dismantled, they need to be replaced and reassembled.

## 3.1.4 Lubrication system

### Specifications

#### Material specification

Name	Specifications	Capacity
Sealant	Loctite 5900	-
Thread locking compound	Loctite 243	-

#### Component specification

Name	Specifications		
Oil pump type	Vane oil pump		
Oil pressure	Engine speed	Idle speed	3,000 rpm
	Oil pressure	≥80kPa	≥150kPa

#### General specifications

#### Lubricating oil specification

Application	Specifications
Viscosity	5W-30(-30 °C and above)
Grade	Level SN and above
Capacity	4.5. 0L

#### Torque specification

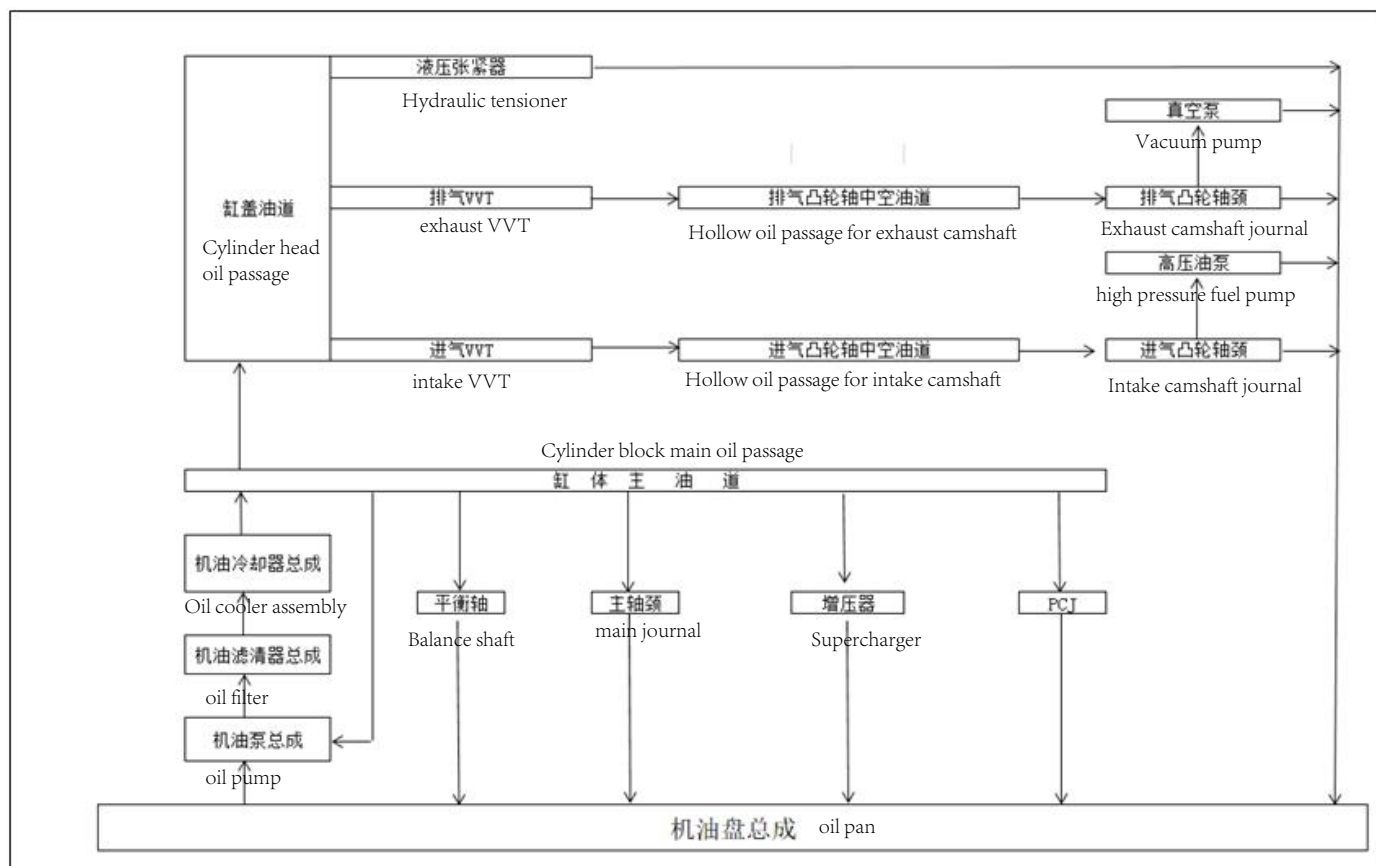
Name	Nm	lb-ft	lb-in
Oil pan drain plug	45	34	-
Oil pan retaining bolts and nuts	10	-	89
Oil pump retaining bolt	23	17	-
Tightening torque of oil filter	30	22	-
Tightening torque of oil filter connecting pipe	23	17	-
Mechanical vacuum pump retaining bolt	10±1	-	89
Piston cooling nozzle retaining bolt	25±2	18	-
Oil cooler assembly retaining bolt	10±1		89
Retaining bolt of engine oil cooler support	13±1	10	
Retaining bolt of lower reinforced plate of crankcase	10±1	-	89
Crankshaft rear end cover retaining bolt	10±1	-	89

## Description and operation

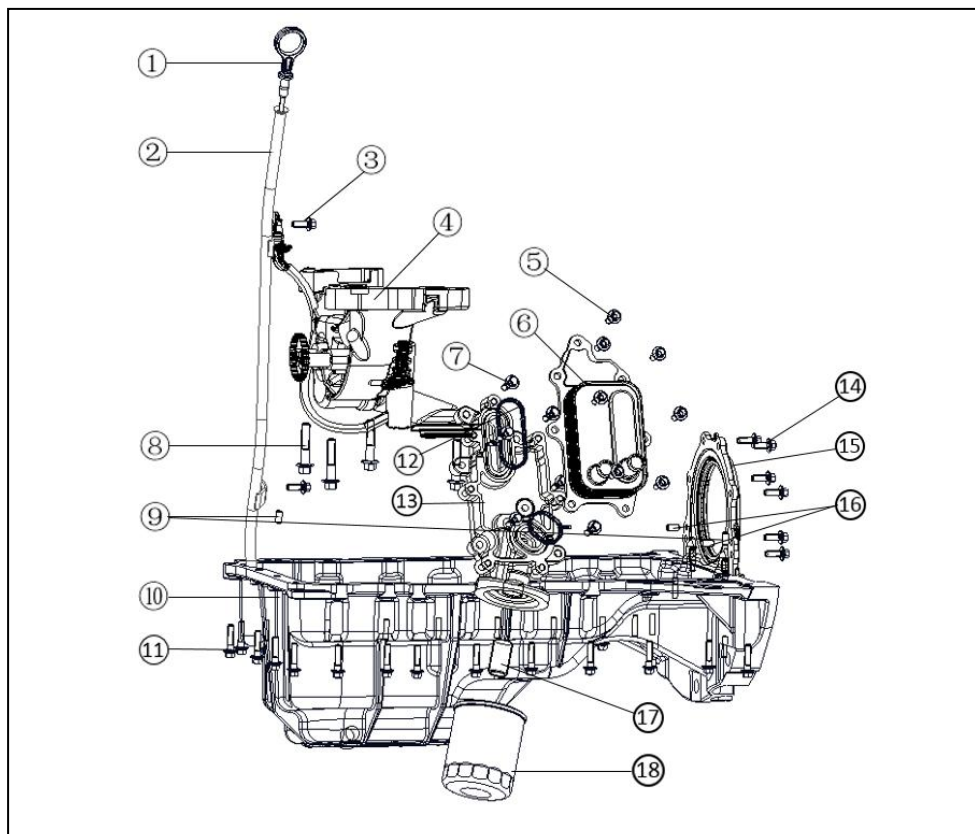
### System overview

The oil pump is driven directly through the crankshaft. After passing through the oil filter, the oil enters the oil filter, and the filtered oil is divided into two oil circuits in the cylinder block. One oil path allows the oil to reach the crankshaft journal bearing. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings through the inclined channels drilled on the crankshaft and sprayed through the fuel injection nozzles to lubricate the pistons, piston rings and cylinder walls. The other oil path allows the engine oil to enter the cylinder head, lubricate the camshaft journal through the shaft cover, lubricate the camshaft shaft diameter and the shaft cover through the hollow oil hole, etc. The oil pump is equipped with a relief valve. When the pressure exceeds  $(8 \pm 0.75)$  bar, the relief valve starts to release pressure.


### Lubricating oil flow diagram



## Exploded view



Project	Description	Project	Description
1	Oil level gauge assembly	10	Oil pan assembly
2	Oil level gauge pipe assembly	11	Bolt
3	Bolt	12	Oil cooler sealing ring
4	Oil pump assembly	13	Oil cooler support
5	Bolt	14	Bolt
6	Engine oil cooler assembly	15	Crankshaft rear end cover assembly
7	Bolt	16	Locating pin
8	Bolt	17	Oil filter connecting pipe
9	Locating pin	18	Engine oil filter assembly

 Note: When replacing the oil filter, check whether the oil filter connecting pipe is loose, and check the filter connecting pipe torque according to  $23\text{N.m} \pm 2\text{N.m}$ .

 Note: Before assembling a new oil filter, apply a little clean oil to the sealing ring surface.

## General inspection

### Oil pressure check



Note: Check the following items before checking the oil pressure:

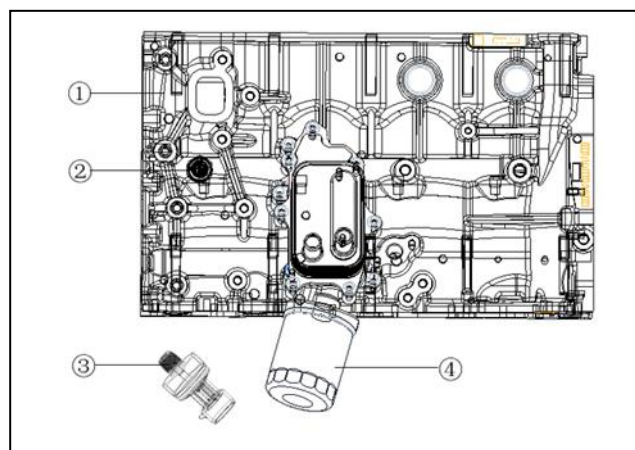
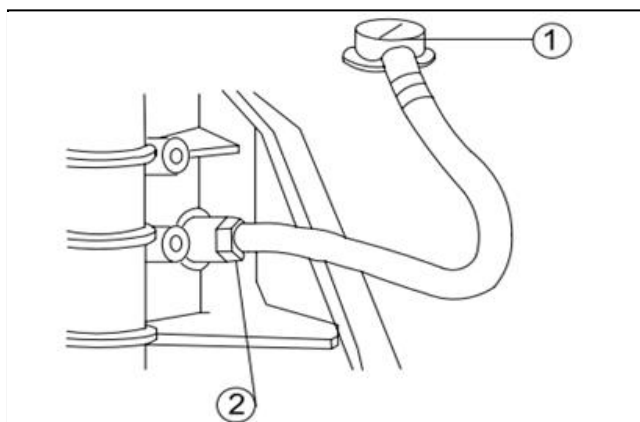
1. Oil level in the oil pan. If the oil level is low, fill to the high oil level mark on the dipstick.
2. Quality of oil.

If the oil is discolored or deteriorated, replace it.

3. Oil leakage.

If oil leakage is found, repair it.

1. Remove oil pressure sensor.
2. Install the special tool (oil pressure gauge) into the empty threaded hole.
3. Fix the oil pressure gauge.
4. Start the engine and warm it up to normal operating temperature.
5. After warm-up, increase the engine speed to 3000 rpm and measure the oil pressure.



Project	Description
1	Crankcase
2	Oil pressure sensor
3	Self-adhesive
4	Engine oil filter assembly

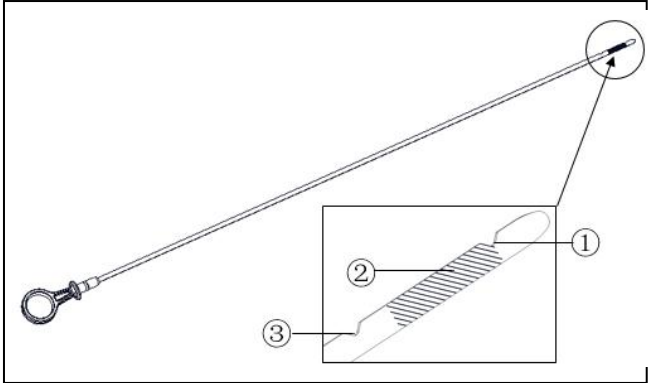
6. After checking the oil pressure, shut down the engine and remove the oil pressure gauge.
7. Replace the oil pressure sensor and tighten the oil pressure sensor to the specified torque.  
Tightening torque:  $14 \pm 1 \text{ N} \cdot \text{m}$  (7.5 ftlb.)
8. Start the engine and check the oil pressure switch for oil leakage.
9. Shut down the engine and connect the harness terminal to the oil pressure sensor.

Project	Special tool	
1	09915-77310 oil pressure gauge	Oil
2	09915-78211 oil pressure gauge holder	Oil

Engine speed	Standard oil pressure
Engine speed	Standard oil pressure
Idle speed	$\geq 80 \text{ kPa}$
At 3000 r/min	$\geq 150 \text{ kPa}$

**Oil level check**

1. Place the vehicle on a level ground.
2. Confirm that the vehicle is cold.
3. Remove the dipstick and check whether the oil level is between MAX and MIN marks on the dipstick.



Project	Description
1	Low oil level mark
2	Recommended oil level area
3	High oil level mark

If the oil level is below the MIN mark, add engine oil.



## Fault symptom diagnosis and test

### General equipment

Oil gauge
Multimeter

### Inspection and confirmation

1. Confirm the customer's problem.
2. Visually inspect for visible signs of mechanical or electrical damage.
3. If the observed or raised problem is obvious and the cause has been found, the cause must be corrected before proceeding to the next step.
4. If the problem cannot be found obviously, confirm the fault and refer to the symptom table.

### Appearance check list

Mechanical	Electrical
<ul style="list-style-type: none"> <li>• Oil pan</li> <li>• Oil pan joint surface</li> <li>• Oil filter</li> </ul>	Electrical plug connection

### Fault symptom table

If the fault occurs but no DTCs are stored in the ECM and the cause of the fault cannot be confirmed in the basic inspection, the fault diagnosis and rule out shall be performed according to the sequence listed in the following table.

Symptoms	Possible causes	Measures
Oil pressure warning lamp is always on	<ul style="list-style-type: none"> <li>• Oil</li> <li>• Oil pump</li> <li>• Oil filter</li> <li>• Oil pressure sensor</li> <li>• Engine main bearing</li> <li>• Connecting rod bearing</li> <li>• Electrical</li> </ul>	Reference: Oil pressure warning lamp always on diagnostic process
Oil pressure warning lamp does not light up	<ul style="list-style-type: none"> <li>• Oil pressure sensor</li> <li>• Circuit</li> <li>• Oil pressure warning lamp LED</li> <li>• Instrument</li> </ul>	Reference: Oil pressure warning lamp does not illuminate diagnostic procedure
Abnormal oil consumption	<ul style="list-style-type: none"> <li>• Leakage</li> <li>• PCV channeling gas consumption</li> <li>• Combustion consumption of combustion chamber</li> </ul>	Reference: Oil Abnormal Consumption Diagnostic Procedure

**Oil pressure warning lamp is constantly on diagnostic process**

 **Note:** Make sure the oil level, oil viscosity and quality are normal before diagnosis. If necessary, change or add oil.

Test conditions	Details/Results/Measures
1. Check oil pressure switch	
	<p>A. Switch off the ignition.</p> <p>B. Disconnect plug connection E06 for oil pressure sensor.</p> <p>C. Switch on the ignition and start the engine.</p> <p>Is the engine oil warning lamp always on?</p> <p>? Yes</p> <p>Go to Step 5.</p> <p>? No</p> <p>Go to step 2.</p>
2. Check oil pressure	
	<p>A. Perform oil pressure check procedure.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>Is the engine oil pressure normal?</p> <p>? Yes</p> <p>Replace the oil pressure sensor.</p> <p>? No</p> <p>Go to Step 3.</p>
3. Check oil pump	
	<p>A. Remove oil pump.</p> <p><a href="#">Reference: 3.1.4 Lubrication system</a></p> <p>B. Check whether the oil pump is normal.</p> <p>? Yes</p> <p>Go to Step 4.</p> <p>? No</p> <p>Replace oil pump.</p>

**Oil Abnormal Consumption Diagnostic Process**

Test conditions	Details/Results/Measures
1. Check for leaks	
	<p>A. Inspect the sealing parts of the engine.</p> <p>Is there any oil leakage?</p> <p>? Yes</p> <p>Repair leakage point.</p> <p>Test whether the system works properly.</p> <p>? No</p> <p>Go to step 2.</p>
2. Check PCVchanneling	
	<p>A. Disconnect PCVconnecting pipe at the inlet trachea.</p> <p>B. Start the engine to increase the engine speed to 4000 rpm.</p> <p>Is there too much exhaust from the PCVconnecting pipe rule out?</p> <p>? Yes</p> <p>Repair the seal between the engine piston and the cylinder.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? No</p> <p>Go to Step 3.</p>
3. Check whether the engine oil burns.	
	<p>A. Start the engine.</p> <p>B. Visually inspect the flue gas color of engine exhaust trachea. Does the engine exhaust trachea exhaust blue smoke?</p> <p>? Yes</p> <p>Repair the engine valve mechanism and the clearance between engine piston and cylinder.</p> <p><a href="#">Reference: 3.1.3 Mechanical system</a></p> <p>? No</p> <p>The system is normal.</p>

## Removal and installation

### Oil pan

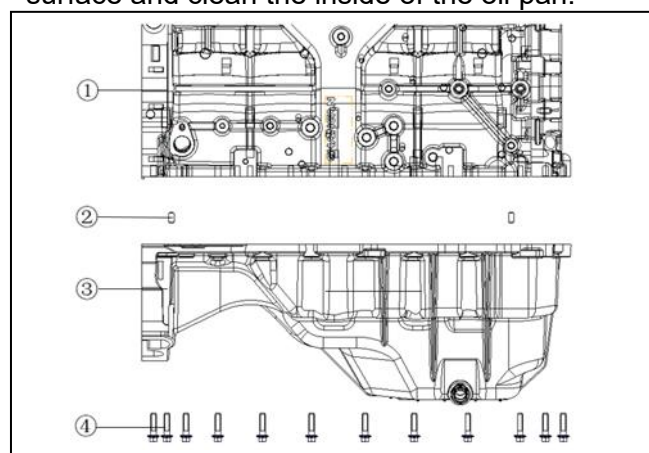
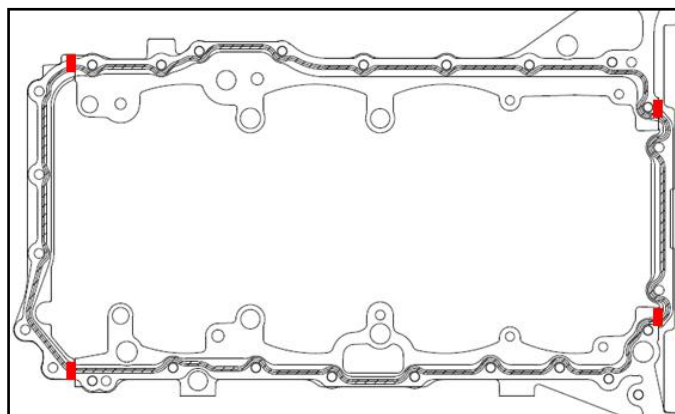
#### Removal

1. Remove the oil drain plug and drain the engine oil.
2. Remove the oil pan bolts, and then remove the oil pan.

#### Cleaning

- Clean the joint surface between the oil pan and the cylinder block.

Remove oil, old sealant and dirt from the joint surface and clean the inside of the oil pan.



Tighten oil drain plug on the oil pan and tighten to 10~50N•m (7.5 ftlb.).

2. Refill the engine with oil and check each joint for no oil leakage.

### Oil pump

#### Removal

1. Disconnect negative battery wire.
2. Drain engine oil.
3. Remove oil pan as described above.
4. Remove the oil pump wire harness as described above.
5. Remove oil pump chain tensioner.
6. Remove the connecting bolts between oil pump and crankcase.
7. Remove oil pump assembly.

#### Check

1. Remove the engine oil pump assembly for inspection. If there is a problem with the engine oil pump assembly, replace it if necessary.

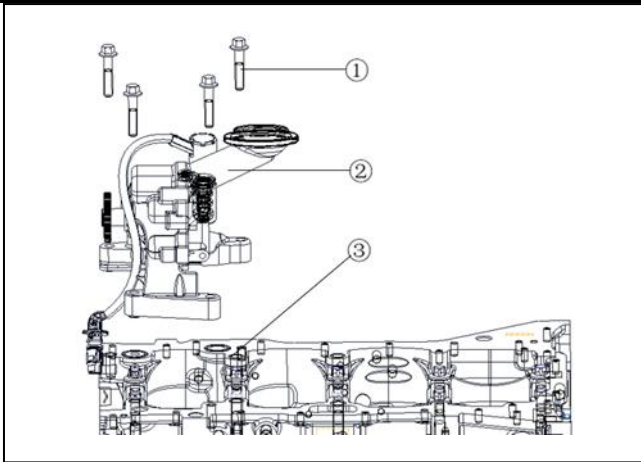
#### Installation

1. Replace oil pump sealing ring.
2. The installation position of oil pump assembly is shown in the figure below. The mounting bolts shall be tightened according to the torque specified in Table A. The oil pump chain assembly shall be installed before tightening the oil pump assembly bolts.

Project	Description
1	Crankcase assembly
2	Locating pin
3	Oil pan assembly
4	Hexagon flange bolt
1	Crankcase assembly

#### Installation

1. Before installing the oil pan, apply glue on the cylinder body surface (joint surface with the oil pan). The glue path is shown in the figure below. Make sure to install the sealant before it hardens and immediately cross the torque specified in Table A or tighten the bolts simultaneously with a tightening machine.



Project	Description
1	Connecting bolt between engine oil pump and crankcase assembly
2	Oil pump assembly
3	Crankcase assembly

3. Install the oil pump harness connector to the front cover.
4. Install the oil pan assembly as described above.
5. Check to ensure that all removed parts have been installed back in place.
6. Refill the engine with engine oil.
7. Connect negative wire of battery.
8. Check each joint without oil leakage.
9. After installation, start the engine to check the oil pressure.

## 3.1.5 Cooling system

### Specifications

#### Component specification

Name	Specifications
Thermostat type	Electronics; Wax type
Thermostat opening temperature in case of no electricity	Electronics: 103 °C $\pm$ 2°C; Machinery: 100 $\pm$ 2°C
Thermostat full on temperature in case of no electricity	Electronics: 115 ° C; Machinery: 115 ° C
Opening and closing of electronic thermostat with power on	Controlled by ECU
Water pump type	Centrifugal impeller pump

#### General specifications

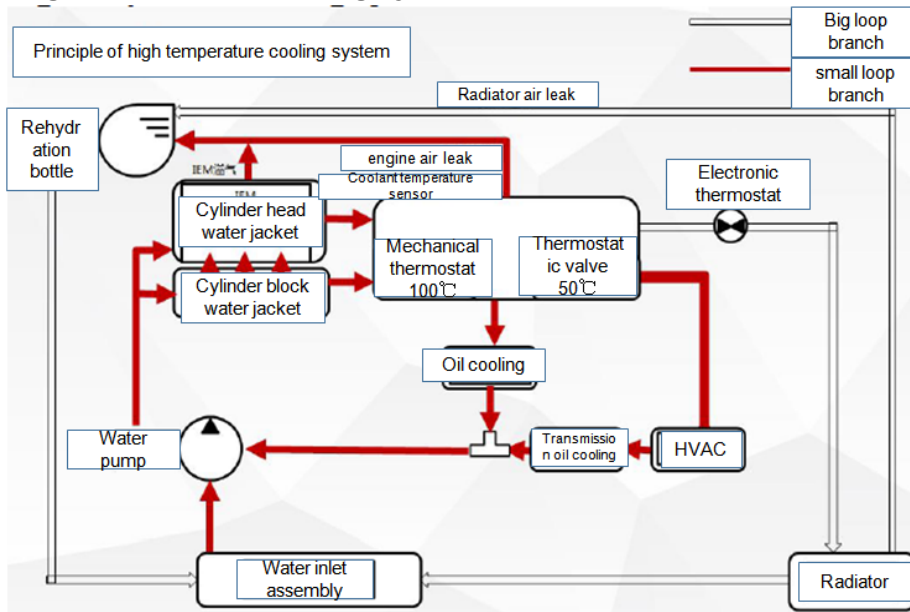
Application	Specifications
Coolant type	Meets LEC- II -40 engine coolant as specified in Q/JD 1028
Cooling type	Water cooling
Coolant capacity(Containing water bottle)	High temperature cooling system: 8.3 $\pm$ 0.2 L Cryogenic cooling system: 3.0 $\pm$ 0.2 L

#### Torque specification

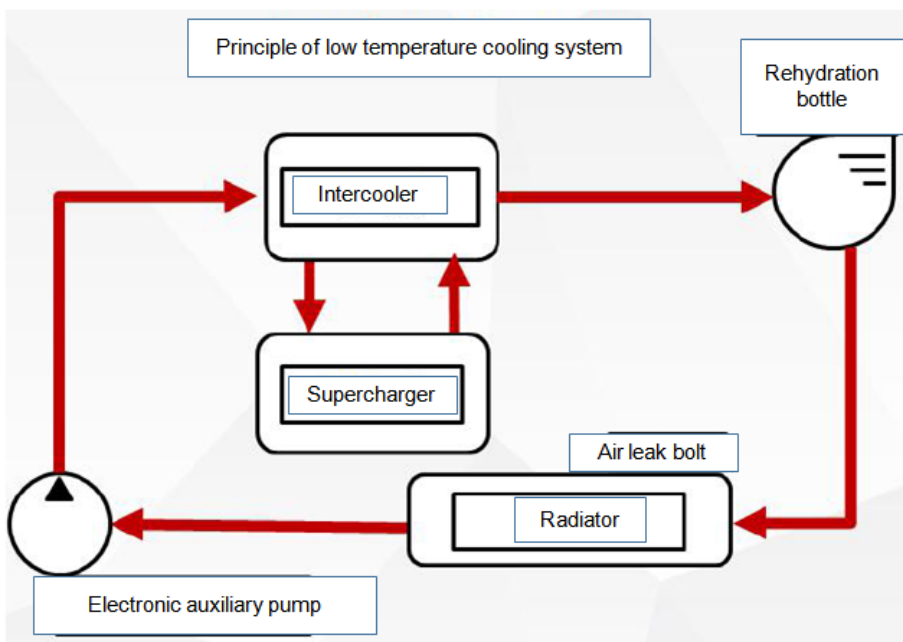
Name	Nm	lb-ft	lb-in
Water pump fixing long bolt	32 $\pm$ 2	24	-
Water pump fixing short bolt	32 $\pm$ 2	24	-
Water pump pulley retaining bolt	10 $\pm$ 1	-	89
Electronic thermostat retaining bolt	10 $\pm$ 1	-	89
Mechanical thermostat retaining bolt	23 $\pm$ 2	17	--
Water inlet pipe retaining bolt	10 $\pm$ 1	-	89

## Coolant flow diagram

### High temperature cooling system



### Cryogenic cooling system



## Description and operation

### System overview

Cooling system is divided into high-temperature cooling system and low-temperature cooling system. High temperature cooling system includes high temperature radiator, water storage bottle, hose, water pump, electronic fan and thermostat. Cryogenic cooling system includes: Intercooler, electronic auxiliary water pump, cryogenic radiator, hose and water storage bottle.

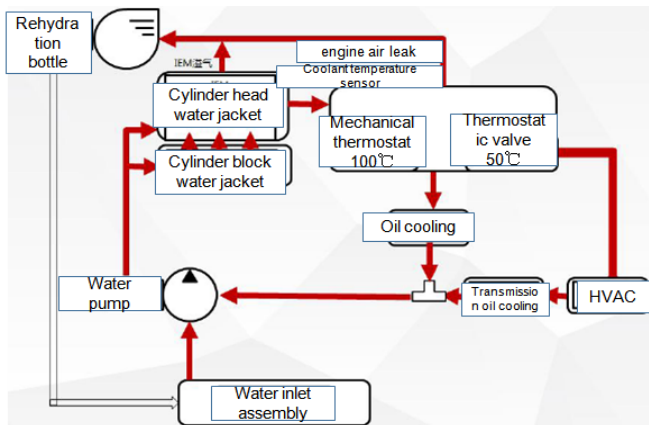
**High-temperature cooling system:** When the engine is cold: The normal working temperature of the engine is generally about 95 °C 203 °F. Within this temperature range, the matching state of all parts of the engine is ideal. If the engine cannot reach the ideal working temperature for a long time, the wear of the engine block will be aggravated. Because the temperature is low, the mixed gas is not fully burnt in the combustion chamber, which will form serious carbon deposit. Therefore, when the engine is at low temperature, it is required

## to work.

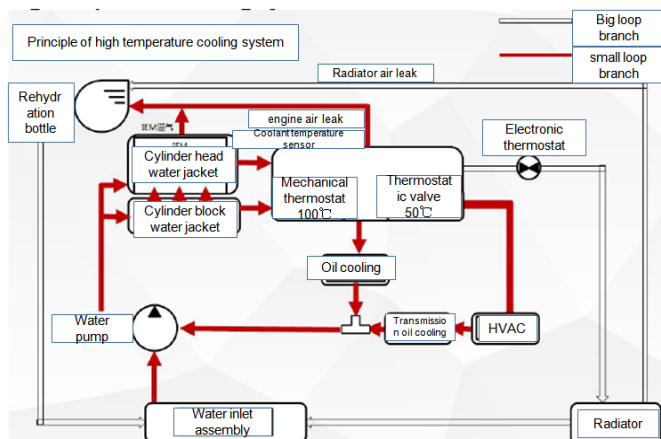
The coolant temperature shall reach the normal working temperature in a short time as far as possible, and the heat generated by the engine shall be exchanged with the outside as little as possible. At this time, the electronic thermostat controls the engine coolant in the engine block to circulate only in the engine block, brings the heat generated around the cylinder wall to other parts of the engine to make the temperature rise rapidly, the water pump circulates the engine coolant in the cylinder block, and then circulates the engine coolant in the engine block water jacket, heater water tank assembly and cylinder head. This state is called "small circulation."

When the antifreeze temperature reaches the target temperature, ECU sends command to control the heating unit of the electronic thermostat according to the engine load, vehicle speed, intake temperature and coolant temperature to control the opening of the thermostat valve. The engine coolant is pumped to the water jacket, cylinder head and high-temperature radiator of the engine block by the water pump. This state is called "large cycle."

1. When the engine warms up (thermostat is closed), the antifreeze circulation is as follows:



2. When the coolant heats up to the normal temperature regulator is turned on, the coolant flows through the radiator and circulates as follows:






## Component description


### Automotive antifreeze

When the engine reaches the normal working temperature: With the engine running, the water supply pump of the water storage bottle makes up water, the engine antifreeze inside the engine body rapidly heats up, and the large cycle is opened when the temperature of the thermostat is reached. The antifreeze in the radiator is thermally expanded and overflowed into the reservoir. The cooling system is factory filled with antifreeze with a high quality freezing point of -40°C.

When antifreeze needs to be replaced, ethylene glycol antifreeze meeting LEC- II -40 requirements shall be used to meet antifreeze temperature -40 °C requirements.

When antifreeze needs to be added, fill ethylene glycol antifreeze meeting LEC- II -40 requirements to meet antifreeze temperature lower than -40 °C.

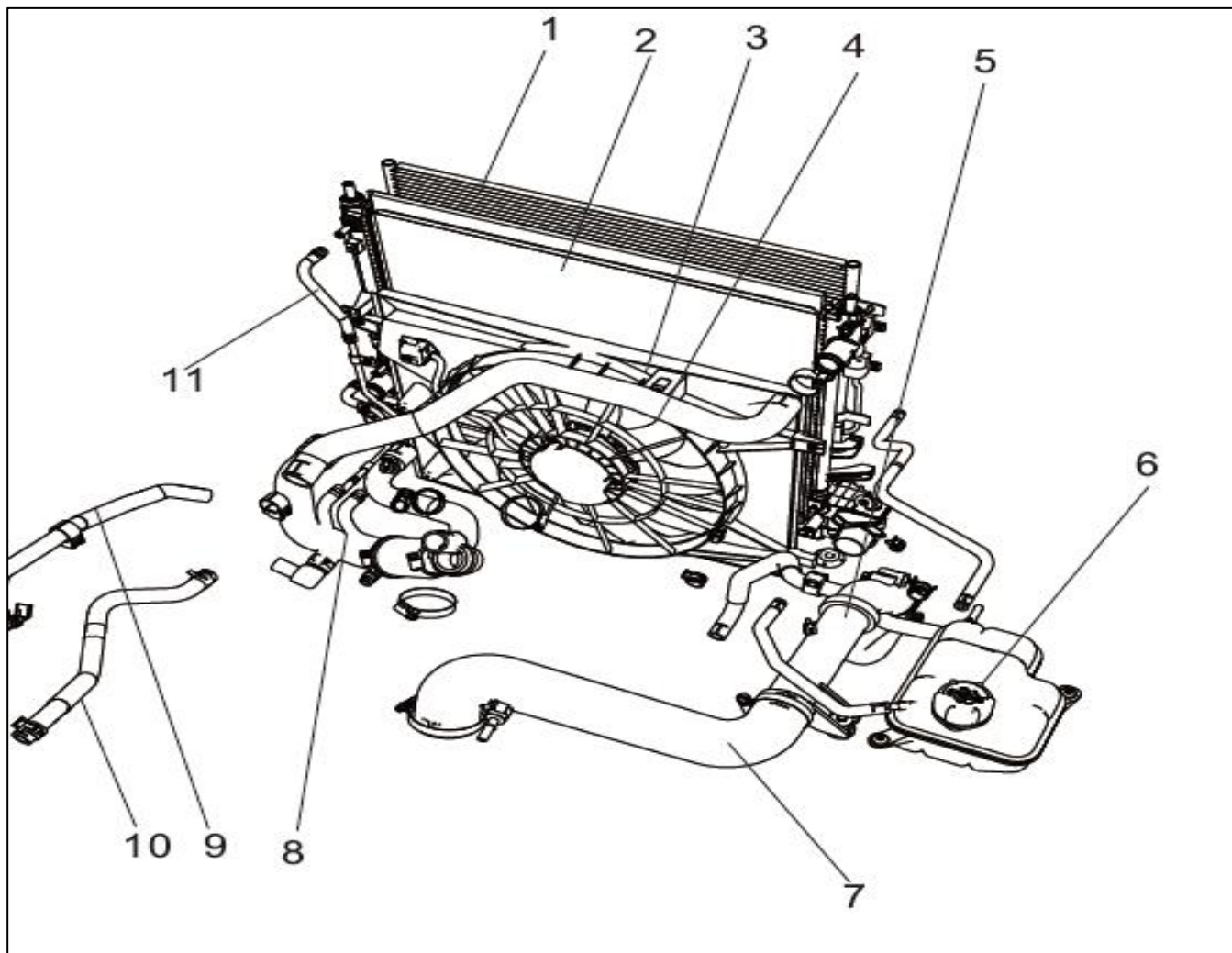
 **Note:** alcohol or methanol antifreeze or use water alone as antifreeze cannot be used for cooling system, otherwise it will cause cooling system fault.

 **Note:** Even if the ambient temperature is not expected to reach the freezing point, the antifreeze with the freezing point of -40°C required by LEC- II -40 shall be used to prevent the cooling system failure.

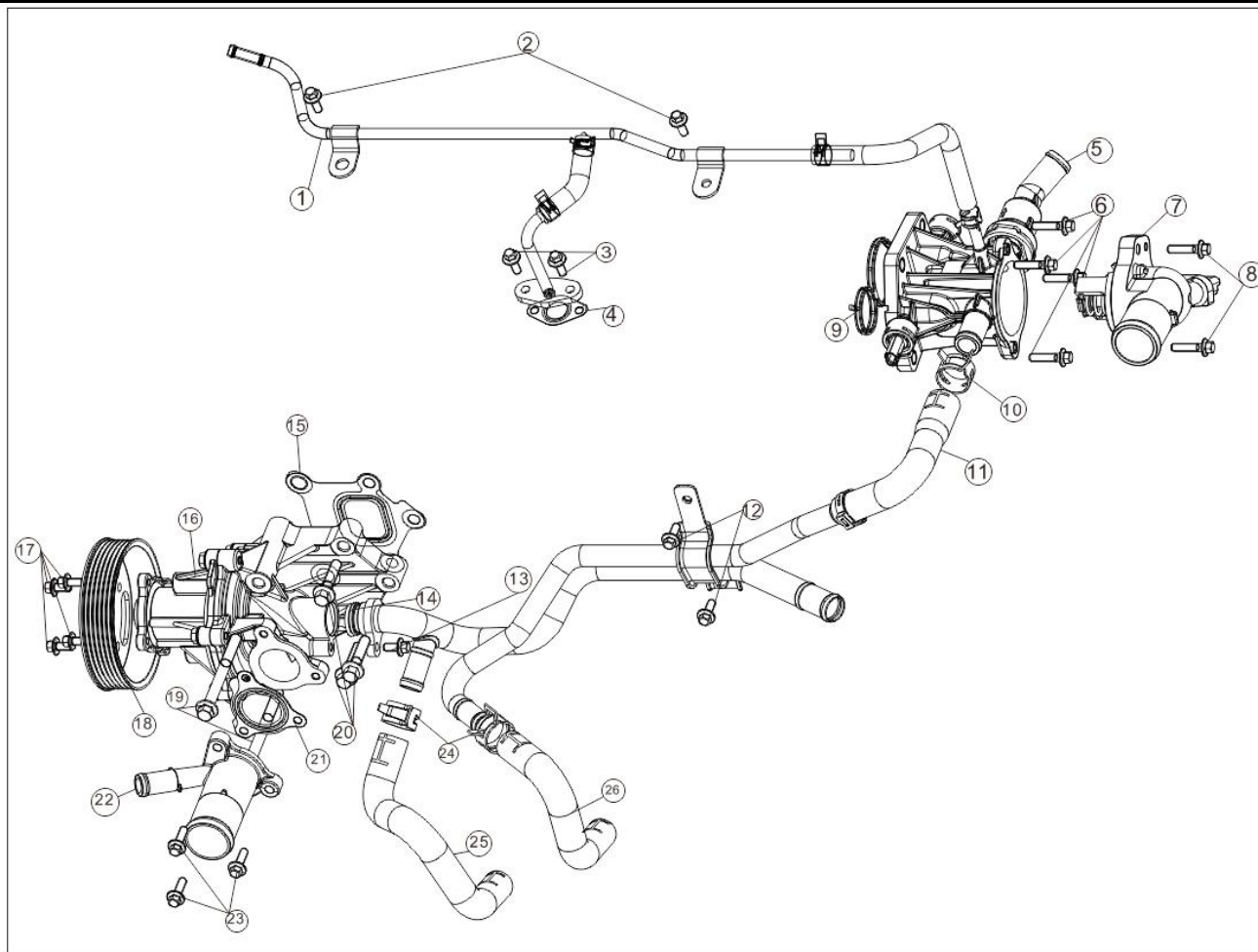
#### Antifreeze information sheet

Engine coolant freezing point and model	Freezing point(°C)	-40
	Model	Meets LEC- II -40 engine coolant as specified in Q/JD 1028
Engine coolant capacity(L)	High temperature cooling system	Approx. 8.0 L
	Cryogenic cooling system	Approx. 3.0 L

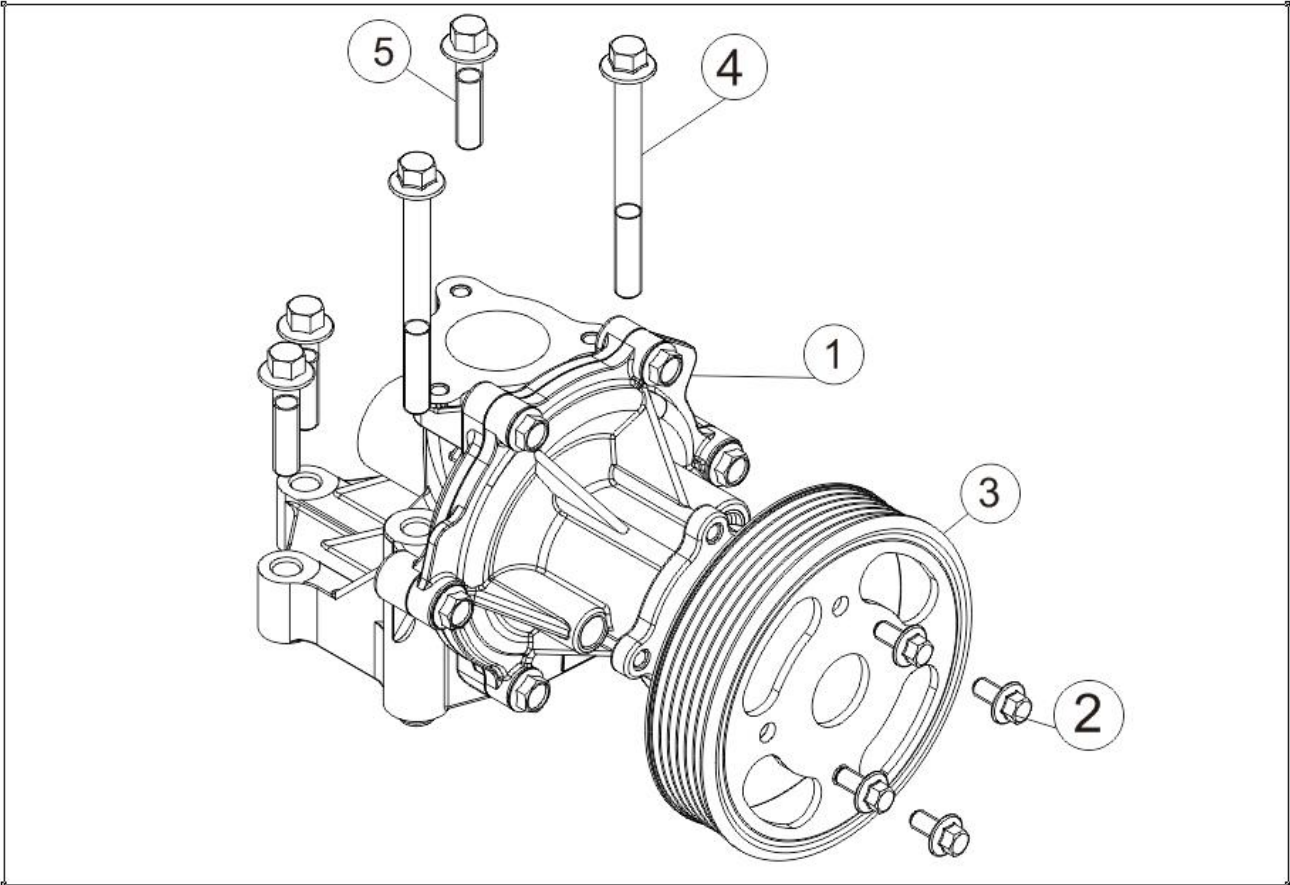
## Exploded view



Project	Description	Project	Description
1	Condenser assembly	7	Intercooler outlet trachea connection pipe
2	Radiator assy.	8	Intercooler inlet trachea
3	Cooling fan assembly	9	HVAC water outlet pipe
4	Radiator inlet pipe	10	HVAC water inlet pipe
5	Intercooler outlet trachea	11	Oil cooler inlet/outlet oil metal pipe assembly
6	Water storage bottle		



Project	Description	Project	Description
1	Overflow trachea assembly(Engine end)	14	Water outlet pipe O-ring
2	Bolt	15	Water pump support gasket
3	Bolt	16	Water pump assembly
4	Overflow trachea gasket	17	Bolt
5	Thermostat assy.	18	Water pump pulley
6	Bolt	19	Bolt
7	Electronic thermostat assembly	20	Bolt
8	Bolt	21	Water inlet pipe gasket
9	Thermostat sealing ring	22	Water inlet pipe assy.
10	Elastic clamp	23	Bolt
11	HVAC water return pipe assy.	24	Elastic clamp
12	Bolt	25	Oil cooler water outlet hose
13	Bolt	26	Oil cooler water inlet hose



Project	Description	Project	Description
1	Water pump assembly	4	Water pump mounting bolt
2	Water pump pulley mounting	5	Water pump mounting bolt
3	Water pump pulley		

## General inspection

**!** Note: alcohol or methanol coolant or water alone cannot be used for cooling system, otherwise it will cause cooling system fault.

**!** Note: Use 45% water and 55% glycol antifreeze (antifreeze/antirust coolant) as coolant to prevent rust and lubrication even when the ambient temperature is not expected to reach the freezing point.

**!** Warning: Disassemble and assemble all parts when the engine is cooled, otherwise they may cause serious burn or personal injury.

**!** Warning: Turn off the engine and wait for it to cool down. However, be very careful when removing the reservoir cap. Wrap a thick cloth around it, rotate slowly counterclockwise, and retreat when the pressure is released.

**!** Warning: When it is sure that all the pressure has been released, rotate the cover with cloth, and then remove it.

**!** Warning: Use coolant at a concentration that meets the driving environment conditions of the vehicle, otherwise the engine may be damaged.

**!** Warning: The engine has aluminum components and must be protected against corrosion and freezing by a glycol-based coolant.

Warning: Use only soft water (demineralized) in the coolant mixture. Water containing minerals reduces the effectiveness of the coolant.

## Coolant level check

**!** Warning: To avoid the danger of scalding, do not open the reservoir cap when the coolant is "boiling."

**!** Warning: In order to avoid the danger of scalding, when the engine and radiator are still hot, the water storage bottle cap cannot be opened.

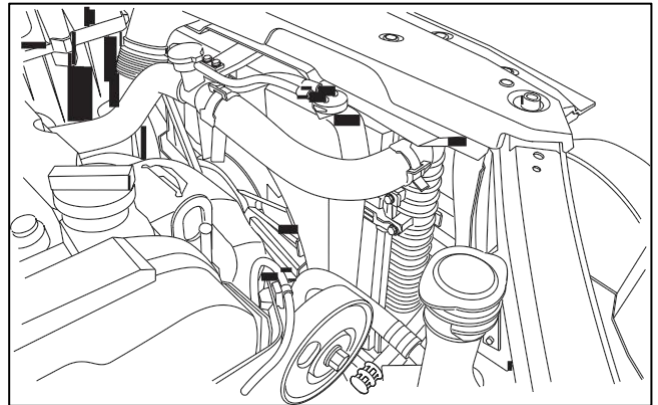
Warning: Boiling liquid and vapor may be ejected under pressure due to too early opening of the reservoir cap.

**!** Note: For maintenance involving dismantling of "water pump and water pipe above generator," "cloth or other auxiliary articles shall be used to block the generator to prevent liquid from entering the

generator."

When the engine is cooled, check the reservoir coolant level. The normal coolant level shall be between the water storage bottles "MAX" and "MIN" marks.

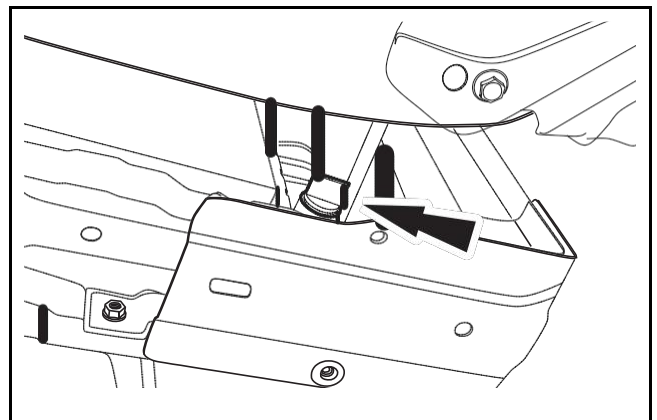
When the coolant level is lower than the "MIN" mark, open the reservoir and add an appropriate amount of coolant to raise the water level to the "MAX" mark. Then, reinstall the reservoir cap.



## Draining and filling of coolant

**!** Warning: In order to avoid the danger of scalding, do not remove the water storage bottle cap when the engine and radiator are still hot. Boiling liquid and steam may be ejected under pressure due to too early opening of the reservoir cap.

1. When the engine is cooled, remove the reservoir cap. While pressing down, slowly rotate the water storage bottle cap in the counterclockwise direction to the first blocking position, slowly release the water storage bottle cap, and remove the water storage bottle cap after the pressure is released.



2. After the reservoir cap is opened, unscrew the drain valve and drain the coolant in the system.
3. Tighten the drain valve. Fill the system with



water and run the engine until the upper radiator hose is hot and hard.

4. Repeat steps (1), (2) and (3) several times until the discharged liquid is close to colorless.
5. Drain the cooling system and tighten the radiator drain plug.
6. Dismantle the water storage bottle, take down the water storage bottle, pour out the liquid, wash the inside of the water storage bottle with soapy water, rinse thoroughly with clean water, drain, and install the water storage bottle and hose.
7. Open the reservoir cap and fill the reservoir with coolant to MAX-ray.
8. When the vehicle is idling, pay attention to the change of coolant level in the storage bottle during the process. After the liquid level drops, replenish the coolant at any time. Tighten the accumulator cap, run the engine from 2500 rpm to 3000 rpm to the fan, then return to idle speed for 1 min, and the vehicle stops. After the engine is cooled, check whether the coolant level drops. If so, repeat the above-mentioned process several times until the coolant level in the storage bottle no longer drops.

### Coolant leakage check

1. Check engine coolant level.
2. Install the tester to the fill port of the reservoir.
3. Apply pressure to 160 kPa using a tester.

**!** **Note:** Make sure that the internal pressure of the radiating water tank does not exceed 200kpa during the check, otherwise it will cause damage.

4. Observe the tester pressure change, each pipe joint and radiator core for leakage of antifreeze.

Standard: When the pressure reaches 160kPa, hold the pressure for 2 minutes, the pressure does not change, and the pipeline joints and radiator core are free of water leakage.

If the pressure indicated by the pressure gauge pointer decreases, this may indicate water leakage. Repair or replace the corresponding parts.

### Reservoir cap inspection

1. Clean the reservoir cap and sealing section.
2. Check sealing rubber of reservoir cap for damage or rollover.

If the reservoir cap does not meet the requirements, replace it.

### Drive belt tension check

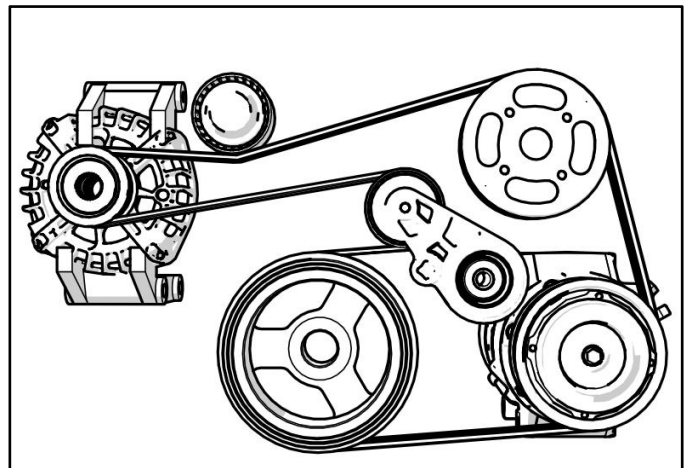
**!** **Warning:** Disconnect the negative wire before checking and adjusting the belt tension.

**!** **Warning:** Read 3.1.4 "Warning" of cooling system.

1. Check the belt for cracks, cuts, deformations, wear and dirt. If necessary, replace the belt.

[Reference: 3.1.3 Mechanical system](#)

2. Check the belt tension. If the front wheel train belt is too loose, the alternator voltage will be affected and the belt will overheat and wear early.
3. Connect the negative wire to the battery terminal.



### Thermostat test

1. Check whether the air exhaust valve of thermostat is clean. If the valve is blocked, the engine will overheat.
2. Check the valve seat for foreign matter, and the valve seat shall be free of foreign matter; otherwise, the valve will not be installed tightly.
3. Inspect the thermostat seal for broken, deformed or other damage.
4. Check the constant temperature action of wax ball as follows:
  - Remove thermostat.

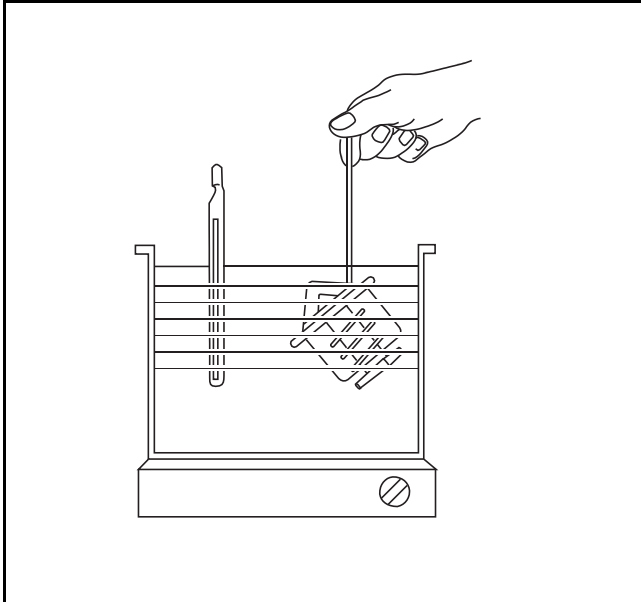
[Reference: 3.1.5 Cooling system](#)

- Immerse the thermostat in heated water.
- Place thermometer in water.
- Heat the water, observe the status of the thermostat, and check whether the temperature when the valve starts to open is the specified temperature.
- The electronic thermostat needs to test the resistance at both ends to confirm whether the

resistance value is  $9.5 \pm 0.95$  ohms. If it exceeds the limit value, replace it.

**Reference: 3.1.5 Cooling system**

- If the temperature at which the valve starts to open is significantly lower or higher than the specified temperature, replace it with a new thermostat. The use of a thermostat that has not met the specified temperature will result in an overcooling or overheating tendency.



## Fault symptom diagnosis and test

### General equipment

Multimeter
Scan tool

### Inspection and confirmation

1. Confirm the customer's problem.
2. Visually inspect for visible signs of mechanical or electrical damage.
3. If the observed or raised problem is obvious and the cause has been found, the cause must be corrected before proceeding to the next step.
4. If the visual inspection is passed, confirm the fault and refer to the fault symptom table.

### Visual inspection list

Mechanical	Electrical
<ul style="list-style-type: none"> <li>• Coolant leakage</li> <li>• Gasket or seal</li> <li>• Hose or hose plug</li> <li>• Reservoir pressure cap and seal</li> <li>• Water storage bottle</li> <li>• Radiator</li> <li>• Water pump</li> <li>• Thermostat housing</li> <li>• Heater tank</li> <li>• Accessory drive belt</li> <li>• Coolant output plug</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse</li> <li>• Harness</li> <li>• Electrical plug connection</li> <li>• Engine coolant temperature (ECT) sensor</li> <li>• Electronic fan</li> <li>• Engine control unit ECM</li> </ul>

**Fault symptom table**

If the fault occurs but no DTCs are stored in the ECM and the cause of the fault cannot be confirmed in the basic inspection, the fault diagnosis and rule out shall be performed according to the sequence listed in the following table.

Symptoms	Possible causes	Measures
Coolant loss	• hose or hose joint	• Inspect whether the hose is aged and whether the hose joint leaks.
	• Radiator	• Check whether the radiator leaks.
	• Water pump	• Inspect whether the water pump leaks. Perform the pressure test package test in 3.1.4 Cooling System. Install a new set of water pumps or water pump gaskets as required. <a href="#">Reference: 3.1.5 Cooling system</a>
	• Thermostat housing	• Inspect whether the thermostat housing leaks. Perform the pressure test package test in 3.1.4 Cooling System. Install a new set of thermostat housing and thermostat housing gaskets as required. <a href="#">Reference: 3.1.5 Cooling system</a>
	• reservoir cap	• Check that the reservoir cap is always locked and damaged. Install a new set of reservoir caps as required.
	• Water storage bottle	• Inspect whether the water storage bottle is damaged. Install a new set of water storage bottles as required.
	• heater tank	• Check whether the heater tank leaks.
	• engine	• Inspect the engine, cylinder head, cylinder block and cylinder gasket.



Symptoms	Possible causes	Measures
Engine overheating(Traces of coolant boiling)	• cooling system cannot maintain pressure	<ul style="list-style-type: none"> <li>Inspect the water storage bottle for damage. Install a new set of water storage bottles as required.</li> <li>Inspect the water pump or water pump gasket for damage. Install a new set of water pumps or water pump gaskets as required.</li> <li>Reference: Water pump(Cooling system 3.1.4-33)</li> <li>Inspect the engine, cylinder head, cylinder block and cylinder gasket.</li> </ul>
	Air in • system	• cooling system air is released.
	• reservoir cap	• Inspect whether the reservoir cap is locked and damaged. Install a new set of reservoir caps as required.
	• Water storage bottle	• Inspect whether the water reservoir is damaged. Install a new set of water storage bottles as required.
	• coolant level or condition	<ul style="list-style-type: none"> <li>Check coolant level. Re-add cooling system as required.</li> <li>Reference: Coolant Drain and Fill(Cooling system 3.1.4-7)</li> <li>Check coolant condition. If the coolant condition is poor, release and refill with new coolant.</li> <li>Reference: Coolant Drain and Fill(Cooling system 3.1.4-7)</li> </ul>
	• Coolant contamination	• Replace coolant
	• Water tank grille	• Check whether the water tank grille is blocked or damaged. Repair or install new parts as required.
	• Water pump	<ul style="list-style-type: none"> <li>Perform the pressure test package test in 3.1.4 Cooling System. Check the water pump for leaks. Install a new set of water pumps or water pump gaskets as required.</li> <li>Reference: 3.1.5 Cooling system</li> </ul>
	• Thermostat	<ul style="list-style-type: none"> <li>Perform the thermostat test kit test in 3.1.4 Cooling System. Install a new set of thermostats and thermostat gaskets as required.</li> <li>Reference: 3.1.5 Cooling system</li> </ul>
	• Accessory drive belt	<ul style="list-style-type: none"> <li>Check the condition of accessory drive belt.</li> <li>Reference: 3.1.3 Mechanical system</li> </ul>
	• engine	• Inspect the engine, cylinder head, cylinder block and cylinder gasket.
	• Electronic fan	Reference: 3.1.5 Cooling system

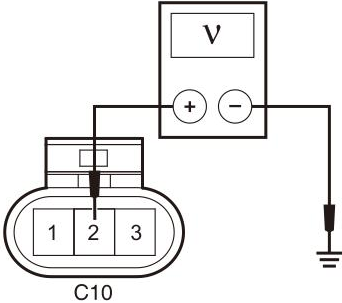
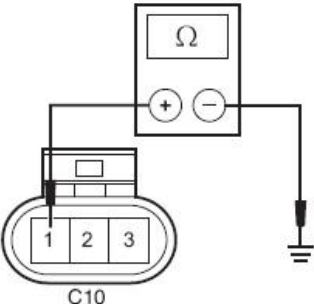
**3.1.5 -13****cooling system****3.1.5-13**

Symptoms	Possible causes	Measures
Engine cannot reach normal working temperature	• Thermostat	<ul style="list-style-type: none"> <li>Perform the thermostat test kit test in 3.1.4 Cooling System. Install a new set of thermostat housing and thermostat housing gaskets as required.</li> </ul> <a href="#">Reference: 3.1.5 Cooling system</a>
	• Electronic fan	<a href="#">Reference: 3.1.5 Cooling system</a>
Turn on A/C fan with great jitter and noise	• High A/C pressure	<ul style="list-style-type: none"> <li>Detect A/C pressure. If the high pressure exceeds 1.52MPa, the cooling fan is running at high speed. Compared with cooling fan running at low speed, excessive jitter and noise are normal.</li> </ul>
	• Cooling fan is attached with mud	<ul style="list-style-type: none"> <li>If mud is attached to the fan blade, clean the scattered blade.</li> </ul>
	• Balance weight on cooling fan blade falls off	<ul style="list-style-type: none"> <li>If the balance weight falls off, replace the cooling fan.</li> </ul>

**Electronic fan low speed non-transfer diagnosis process**

Test conditions	Details/Results/Measures
1. Check fault code	
	<p>A. Connect the diagnostic scanner and turn the ignition switch to "ON" position.</p> <p>B. Diagnose engine system. Is there any cooling system fault code?</p> <p>? Yes</p> <p><a href="#">Reference: 3.1.2 On-board diagnosis</a></p> <p>? No</p> <p>Go to step 2.</p>
2. Perform electronic fan low speed drive test	

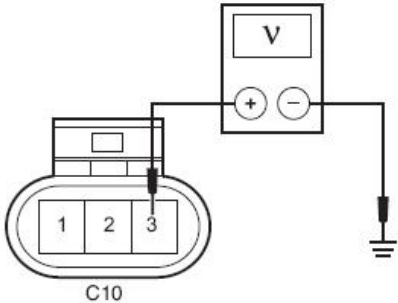
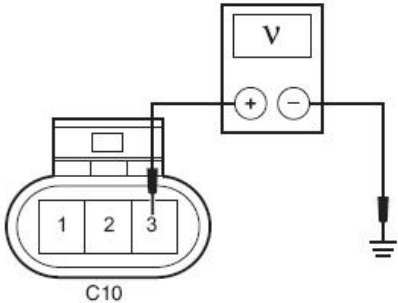
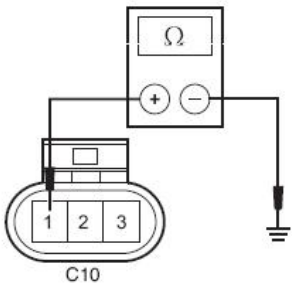
	<p>A. Connect diagnostic scanner</p> <p>B. Turn the ignition switch to the "ON" position, and use the diagnostic scanner to actively test the low-speed cooling fan.</p> <p>Does the fan rotate at low speed?</p> <p>? Yes</p> <p>Check coolant temperature sensor.</p> <p><a href="#">Reference: 3.1.2 On-board diagnosis</a></p> <p>? No</p> <p>Go to Step 3.</p>
3. Check fuse	
	<p>A. Check the status of SB09 and EF03 fuses.</p> <p>Is the fuse normal?</p> <p>? Yes</p> <p>Go to Step 4.</p> <p>? No Inspect and repair the fuse circuit and</p>
4. Check low speed relay control circuit	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Use special tool for removing harness plug terminal to disconnect terminal No.56 of ECM harness plug C15.</p> <p>C. Turn the ignition switch to "ON" position.</p> <p>D. Make terminal No.56 of ECM harness plug C15 short to reliable grounding.</p> <p>Is the cooling fan running at low speed?</p> <p>? Yes</p> <p>Go to step 10.</p> <p>? No</p>

Test conditions	Details/Results/Measures
5. Check low speed circuit from engine compartment electrical center to ECM.	
	<p>A. Turn the ignition switch to "LOCK" position.  B. Disconnect the battery negative cable.  C. Disconnect ER07 relay of engine compartment electrical center C01.  D. Measure the resistance between terminal 120 of relay ER07 of engine compartment electrical center C01 and terminal 56 of ECM harness plug C15.  Standard resistance: Less than 5 <math>\Omega</math>  Is the resistance normal?  ? Yes  Go to Step 6.  ? No</p>
6. Check low-speed cooling fan power supply	
 <p>A3104011</p>	<p>A. Turn the ignition switch to "LOCK" position.  B. Install engine compartment electrical center relay ER07.  C. Disconnect the radiator fan motor harness plug C10.  D. Turn the ignition switch to "ON" position.  E. Ground terminal No.56 of ECM harness plug C15 and reliable grounding point.  F. Measure the voltage between terminal 2 of radiator fan motor harness plug C10 and reliable grounding point.  Standard voltage: 11~14 V  Is the voltage normal?  ? Yes  Go to Step 7.  ? No  Go to Step 8</p>
7. Check grounding circuit of fan motor	
 <p>A3104013</p>	<p>A. Measure the resistance between terminal 1 of radiator fan motor harness plug C10 and reliable grounding point.  Standard resistance: Less than 5 <math>\Omega</math>  Is the resistance normal?  ? Yes  Replace the fan motor.  Confirm the system is normal.  ? No  Overhaul open circuit fault from terminal No.1 of radiator fan motor harness plug C10 to grounding point G 301.</p>

Test conditions	Details/Results/Measures
8. Check power supply circuit of fan motor	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect engine compartment electrical center relay ER07.</p> <p>C. Measure the resistance between terminal 122 of engine compartment electrical center C01 and terminal 2 of fan motor harness plug C10.</p> <p>Standard resistance: Less than 5 <math>\Omega</math></p> <p>Is the resistance normal? ? Yes to step 9.</p> <p>? No</p> <p>Overhaul open circuit fault between terminal 122 of engine compartment electrical appliance center C01</p>
9. Check low speed fan relay	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Interchange low speed fan relay ER07 with the same model normal vehicle. Is the fan working properly?</p> <p>? Yes</p> <p>Replace the faulty vehicle relay ER07. Confirm the system is normal.</p> <p>? No</p> <p>Overhaul the engine compartment electrical appliance</p>
10. Check ECM power supply circuit	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Measure from the back of ECM harness plug C15.</p> <p>C. Turn the ignition switch to "ON" position, and measure the voltage between terminals 15, 16, 20 and 35 of ECM harness plug C15 and reliable grounding point with a multimeter.</p> <p>Standard voltage: 11~14 V</p> <p>Is the voltage normal?</p> <p>? Yes</p> <p>Go to Step 11.</p> <p>? No</p>
11. Check ECM grounding circuit	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect the battery negative cable.</p> <p>C. Disconnect the ECM harness plug C15, E01.</p> <p>D. Measure the resistance between terminals 63 and 64 of ECM harness plug C15 and terminals 111 and 112 of E01 and reliable grounding with a multimeter.</p> <p>Standard resistance: Less than 5<math>\Omega</math></p> <p>Is the resistance normal?</p> <p>? Yes</p> <p>Replace the engine control module,</p> <p>? No</p> <p>Overhaul ECM grounding circuit.</p>

## Troubleshooting process of high speed non-rotation of electronic fan

Test conditions	Details/Results/Measures
1 Check fault code	
	<p>A. Connect the diagnostic scanner and turn the ignition switch to "ON" position.</p> <p>B. Diagnose engine system. Is there any cooling system fault code?</p> <p>? Yes</p> <p><a href="#">Reference: 3.1.2 On-board diagnosis.</a></p> <p>? No</p> <p>Go to step 2.</p>
2. Perform high-speed drive test of electronic fan	
	<p>A. Connect the diagnostic scanner.</p> <p>B. Turn the ignition switch to the "ON" position, and use the diagnostic scanner to actively test the high-speed cooling fan.</p> <p>Does the fan rotate at high speed?</p> <p>? Yes</p> <p>Check coolant temperature sensor.</p> <p>? No</p> <p>Go to Step 3.</p>
3. Check fuse	
	<p>A. Check the status of SB09 and EF03 fuses.</p> <p>Is the fuse normal?</p> <p>? Yes</p> <p>Go to Step 4.</p> <p>? No Inspect and repair the fuse circuit and replace the corresponding fuse.</p>
4. Check high-speed relay control circuit	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect ECM harness plug with special tool for removing harness plug terminal Terminal 31 of C15.</p> <p>C. Turn the ignition switch to "ON" position.</p> <p>D. Ground terminal 31 of ECM harness plug C15 with reliable grounding point.</p> <p>Is the cooling fan running at high speed?</p> <p>? Yes</p> <p>Go to step 10.</p> <p>? No</p> <p>Go to Step 5</p>

Test conditions	Details/Results/Measures
5. Inspect the high-speed circuit from the engine compartment electrical center to the ECM.	
 <p>A3104020</p>	<p>A. Turn the ignition switch to "LOCK" position.  B. Disconnect the battery negative cable.  C. Disconnect engine compartment electrical center relay ER02.  D. Disconnect development engine ECM harness plug C15.  E. Measure the resistance between terminal 96 of relay ER02 of engine compartment electrical center C01 and terminal 31 of ECM harness plug C15.  Standard resistance: Less than 5 <math>\Omega</math>  Is the resistance normal?  ? Yes  Go to Step 6.  ? No  Overhaul open circuit fault from terminal 96 of relay ER02 of engine compartment electrical center C01 to terminal 31 of ECM harness plug C15.</p>
6. Check high-speed fan power supply	
 <p>A3104020</p>	<p>A. Turn the ignition switch to "LOCK" position.  B. Install engine compartment electrical center relay ER02.  C. Disconnect the radiator fan motor harness plug C10.  D. Turn the ignition switch to "ON" position.  E. Ground terminal 31 of ECM harness plug C15 with reliable grounding point.  F. Measure the voltage between terminal 3 of radiator fan motor harness plug C10 and reliable grounding point.  Standard voltage: 11 ~ 14 V  Is the resistance normal?  ? Yes  Go to Step 7.  ? No  Go to Step 8.</p>
7. Check grounding circuit of fan motor	
 <p>A3104013</p>	<p>A. Measure the resistance between terminal 1 of radiator fan motor harness plug C10 and reliable grounding point.  Standard resistance: Less than 5 <math>\Omega</math>  Is the resistance normal?  ? Yes  Replace the fan motor.  Confirm the system is normal.  ? No  Overhaul open circuit fault from radiator fan motor harness plug C10 terminal No.1 to grounding point G 301.</p>

Test conditions	Details/Results/Measures
8. Check power supply circuit of high-speed fan motor	
	<p>A. Turn the ignition switch to "LOCK" position.  B. Disconnect the engine compartment electrical center relay ER02.  C. Disconnect fan motor harness plug C10.</p> <p>Resistance from terminal 93 of to terminal 3 of fan motor harness plug C10.  Standard resistance: Less than 5Ω  Is the resistance normal?  ? Yes  Go to step 9.  ? No  Overhaul open circuit fault from terminal 93 of relay ER02 of engine compartment electrical center C01 to terminal 3 of fan motor harness plug C10.</p>
9. Check high-speed fan relay	
	<p>A. Turn the ignition switch to "LOCK" position.  B. Interchange high-speed fan relay ER02 with the same model normal vehicle. Is the fan working properly?  ? Yes  Replace the faulty vehicle relay ER02. Confirm the system is normal.  ? No  Overhaul the engine compartment electrical appliance center C01 and replace the engine compartment</p>
10. Check ECM power supply circuit	
	<p>A. Turn the ignition switch to "LOCK" position.  B. Measure from the back of ECM harness plug C15.  C. Turn the ignition switch to "ON" position, and measure the voltage between terminals 15, 16, 20 and 35 of ECM harness plug C15 and reliable grounding with a multimeter.  Standard voltage: 11~ 14 V  Is the voltage normal?  ? Yes  Go to Step 11.  ? No  Overhaul ECM power supply circuit.</p>



Test conditions	Details/Results/Measures
11. Check ECM grounding circuit	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect the battery negative cable.</p> <p>C. Disconnect the ECM harness plug C15, E01.</p> <p>D. Measure the resistance between terminals 63 and 64 of ECM harness plug C15 and terminals 111 and 112 of E01 and reliable grounding with a multimeter.</p> <p>Standard resistance: Less than 5Ω</p> <p>Is the resistance normal?</p> <p>? Yes</p> <p>Replace the engine control module,</p> <p>? No</p> <p>Overhaul ECM grounding circuit.</p>

**Electronic fan low speed normal transfer diagnosis process**

Test conditions	Details/Results/Measures
1 Check fault code	
	<p>A. Connect the diagnostic scanner and turn the ignition switch to "ON" position.</p> <p>B. Diagnose engine system. Is there any cooling system fault code?</p> <p>? Yes</p> <p><a href="#">Reference: 3.1.2 On-board diagnosis.</a></p> <p>? No</p> <p>Go to step 2.</p>
2. Dismantle low-speed fan relay	
	<p>A. Remove the low speed fan relay ER07.</p> <p>Is the fan still working?</p> <p>? Yes</p> <p>Overhaul the wiring between terminal 122 of engine compartment electrical center C01 relay ER07 and terminal 2 of fan motor harness plug C10. If necessary, replace engine compartment electrical center C01.</p> <p>? No</p> <p>Go to Step 3.</p>
3.Check ER07 relay	
	<p>A. Interchange ER07 relay with the same model normal vehicle.</p> <p>Is the fan still working?</p> <p>? Yes</p> <p>Go to Step 4.</p> <p>? No</p> <p>Replace the faulty vehicle relay ER07. Confirm the system is normal.</p>

Test conditions	Details/Results/Measures
4. Check low speed circuit from engine compartment electrical center to ECM.	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect the battery negative cable.</p> <p>C. Remove the low speed fan relay ER07.</p> <p>D. Disconnect ECM harness plug C15.</p> <p>E. Measure engine compartment electrical center harness plug C01 relay ER06</p> <p>Resistance between terminal 120 of and reliable grounding.</p> <p>Standard resistance: 10 MΩ or higher</p> <p>Is the resistance normal?</p> <p>? Yes to step 5→ No</p> <p>Overhaul short circuit between terminal 120 of relay ER06 of engine compartment electrical center C01 and terminal 56 of ECM harness plug C15.</p>
5. Check ECM power supply circuit	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Connect ECM harness plug C15.</p> <p>C. Measure from the back of ECM harness plug C15.</p> <p>D. Turn the ignition switch to "ON" position, and measure the voltage between terminals 15, 16, 20 and 35 of ECM harness plug C15 and reliable grounding with a multimeter.</p> <p>Standard voltage: 11~ 14 V</p> <p>Is the voltage normal? ? Yes to step 6.</p> <p>? No</p> <p>Overhaul ECM power supply circuit.</p>
6. Check ECM grounding circuit	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect the battery negative cable.</p> <p>C. Disconnect the ECM harness plug C15, E01.</p> <p>D. Measure the resistance between terminals 63 and 64 of ECM harness plug C15 and terminals 111 and 112 of E01 and reliable grounding with a multimeter.</p> <p>Standard resistance: Less than 5Ω</p> <p>Is the resistance normal?</p> <p>? Yes</p> <p>Replace the engine control module,</p> <p>? No</p> <p>Overhaul ECM grounding circuit.</p>

**Electronic fan high-speed normal rotation fault diagnosis process**

Test conditions	Details/Results/Measures
1 Check fault code	
	<p>A. Connect the diagnostic scanner and turn the ignition switch to "ON" position.</p> <p>B. Diagnose engine system. Is there any cooling system fault code?</p> <p>? Yes</p> <p><a href="#">Reference: 3.1.2 On-board diagnosis</a></p> <p>? No</p> <p>Go to step 2.</p>
2.Remove high-speed fan relay ER02	
	<p>A. Remove high-speed fan relay ER02.</p> <p>Is the fan still working at high speed?</p> <p>? Yes</p> <p>Overhaul the wiring from the engine compartment electrical center harness plug C01 relay ER02 terminal No.93 to the fan motor harness plug C10 terminal No.3 to power supply positive short circuit fault. If necessary, replace the engine compartment electrical center C01.</p> <p>? No</p> <p>Go to Step 3.</p>
3.Check relay ER02	
	<p>A. Replace relay ER02 with the same model normal vehicle.</p> <p>Is the fan still working at high speed?</p> <p>? Yes</p> <p>Go to Step 4.</p> <p>? No Replace faulty vehicle relay. Confirm the system is normal.</p>
4. Check the circuit from the engine compartment electrical center to the ECM.	
	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect the battery negative cable.</p> <p>C. Remove the low speed fan relay ER02.</p> <p>D. Disconnect ECM harness plug C15.</p> <p>E. Measure engine compartment electrical center harness plug C01 relay ER02</p> <p>Resistance between terminal 96 of and reliable grounding.</p> <p>Standard resistance: 10 MΩ or higher</p> <p>Is the resistance normal?</p> <p>? Yes</p> <p>Go to Step 5.</p> <p>? No</p> <p>Overhaul the short circuit from terminal 96 of relay ER02 of engine compartment electrical center harness plug C01 to terminal 24 of ECM harness plug C15 to ground</p>
Test conditions	Details/Results/Measures

5. Check ECM power supply circuit	
	<p>A. Turn the ignition switch to "LOCK" position. B. Connect ECM harness plug C15. C. Measure from the back of ECM harness plug C15. D. Turn the ignition switch to "ON" position, and measure the voltage between terminals 15, 16, 20 and 35 of ECM harness plug C15 and reliable grounding with a multimeter. Standard voltage: 11~ 14 V Is the voltage normal? ? Yes Go to Step 6. ? No Overhaul ECM power supply circuit.</p>
6. ECM grounding circuit	
	<p>A. Turn the ignition switch to "LOCK" position. B. Disconnect the battery negative cable. C. Disconnect the ECM harness plug C15, E01. D. Measure the resistance between terminals 63 and 64 of ECM harness plug C15 and terminals 111 and 112 of E01 and reliable grounding with a multimeter. Standard resistance: Less than 5Ω Is the resistance normal? ? Yes Replace the engine control module, ? No Overhaul ECM grounding circuit.</p>

## Removal and installation

### Upper cooling water pipe

#### Removal

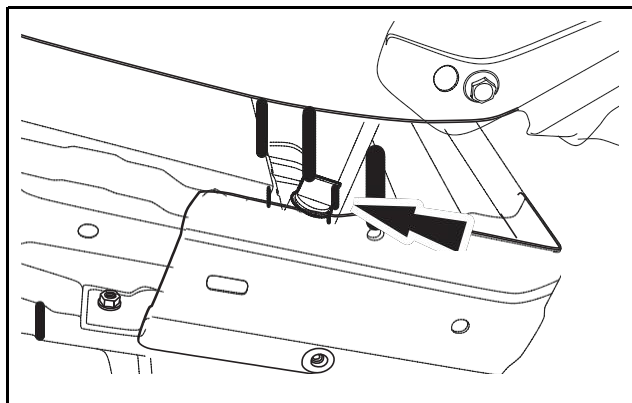
1. Disconnect the negative battery harness.

Reference: 3.1.11 charging system

2. Lift the vehicle.

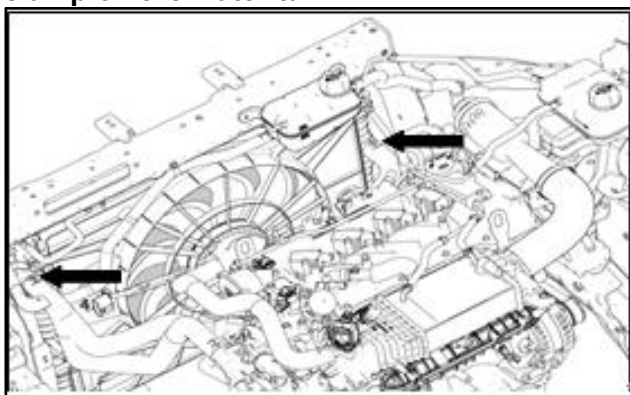
Reference: 1.1.3 Towing and lifting

3. Loosen the radiator drain plug and drain the cooling system.

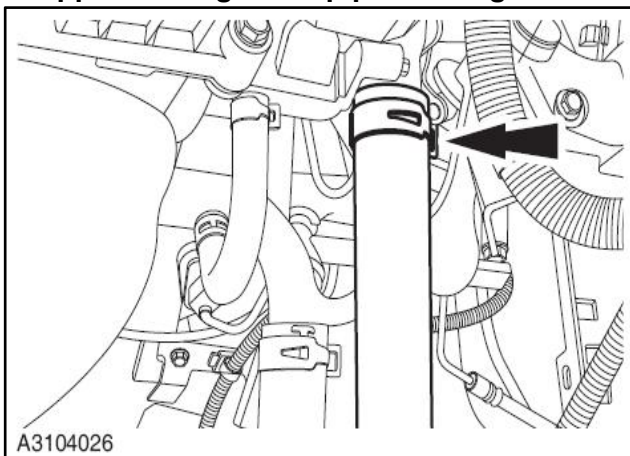


4. Lower the vehicle.

5. Loosen the cooling water pipe retaining clamp on the water tank.



6. Loosen the clamp on the connecting end of upper cooling water pipe and engine.



7. Take out upper cooling water pipe.

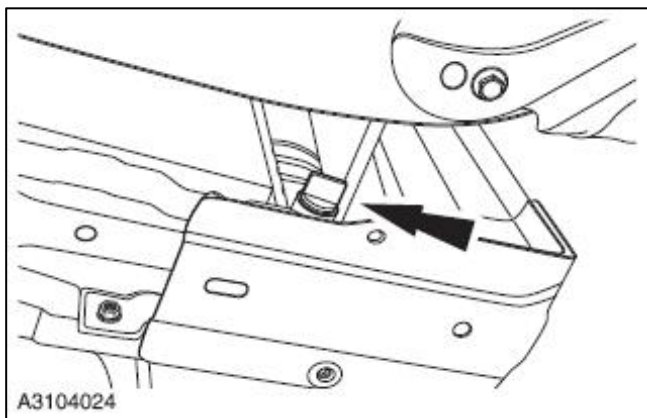
#### Installation

1. The installation sequence is the reverse of the removal sequence.
2. Refill coolant.
3. Start the engine and check the cooling system for leaks.

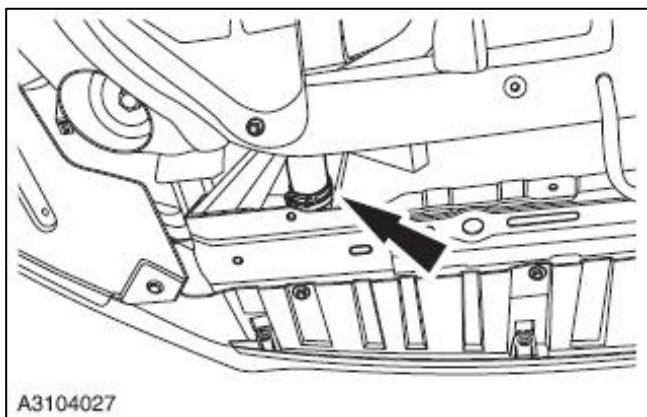
## Lower cooling water pipe

### Removal

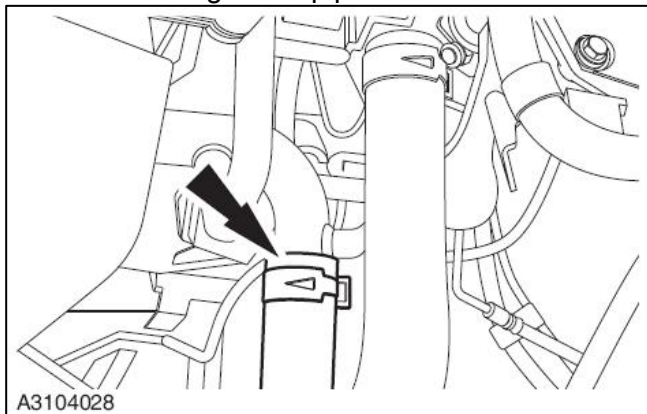
1. Disconnect the negative battery harness.  
[Reference: 3.1.11 charging system](#)
2. Lift the vehicle.  
[Reference: 1.1.3 Towing and lifting](#)
3. Loosen the radiator drain plug and drain the cooling system.



4. Loosen the cooling water pipe retaining clamp on the water tank.



5. Lower the vehicle.
6. Loosen the retaining clamp at the other end of the lower cooling water pipe.

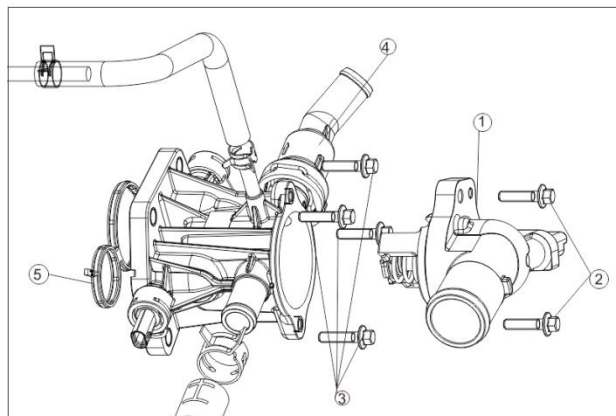


7. Take out lower cooling water pipe.

### Installation

1. The installation sequence is the reverse of the removal sequence.
2. Refill coolant.
3. Start the engine and check the cooling system for leaks.

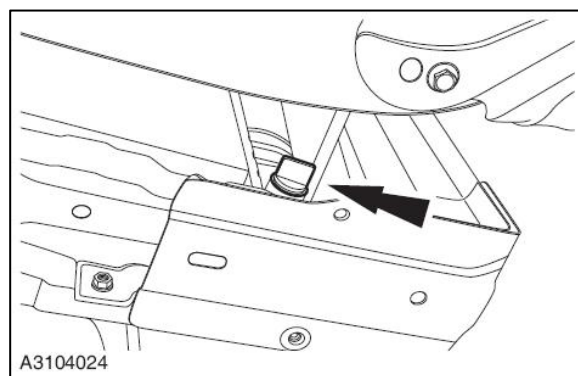
## Thermostat



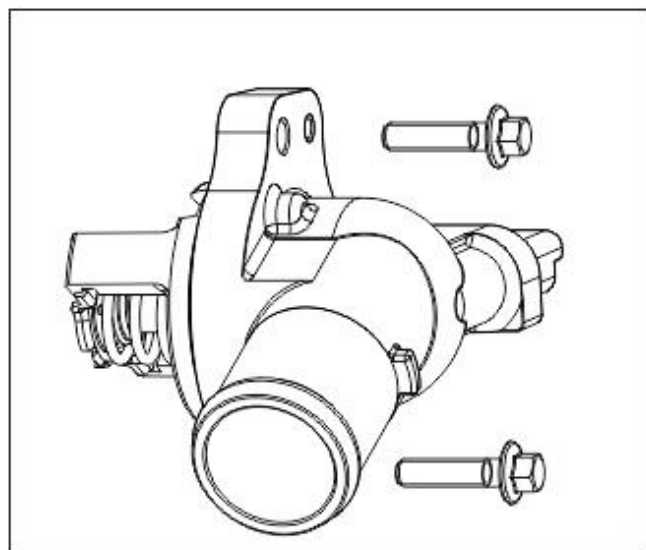
Project	Description
1	Electronic thermostat assembly
2	Bolt
3	Bolt
4	Thermostat assy.(Thermostat base integrated mechanical thermostat)
5	Thermostat gasket

### Removal

1. Remove battery negative wire.  
[Reference: 3.1.11 charging system](#)
2. Lift the vehicle.  
[Reference: 1.1.3 Towing and lifting](#)
3. Drain coolant and tighten drain plug.



4. Remove battery, electronic thermostat contact harness and related connection circuit.
5. Remove retaining bolts of electronic thermostat thermostat. Torque: 10N.m
6. Remove the electronic thermostat assembly from the thermostat assembly.



### Check

1. Check whether the air exhaust valve of the electronic thermostat is clean. If the valve is blocked, the engine will overheat.
2. Check the valve seat for foreign matter, and the valve seat shall be free of foreign matter; otherwise, the valve will not be installed tightly.
3. Inspect the thermostat seal for broken, deformed or other damage.
4. Check the constant temperature action of wax ball as follows:
  - A. Immerse the thermostat in water and heat the water gradually.
  - B. Check whether the temperature when the valve starts to open is the specified temperature.
  - C. If the temperature at which the valve starts to open is significantly lower or higher than the specified temperature, replace it with a new thermostat. The use of a thermostat that has not met the specified temperature will result in an overcooling or overheating tendency.

### Installation

1. The installation sequence is the reverse of the removal sequence.
2. The cooling system is filled with coolant.
3. Connect the battery negative wire.
4. After installation, check all parts for leakage.

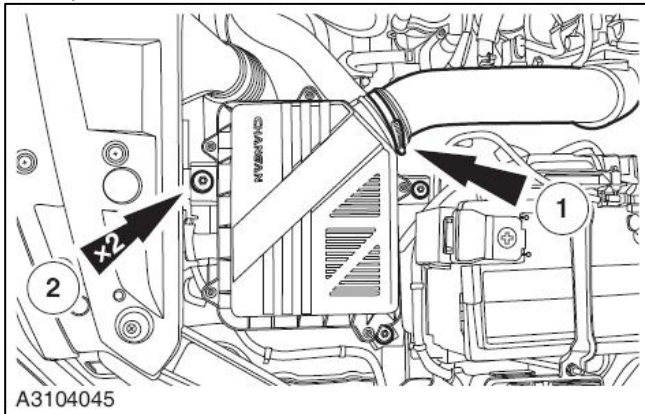


Mechanical specifications	thermostat	functional
Temperature at which the valve starts to open		100°C
Temperature when valve is fully open		115°C

## Radiator

### Removal

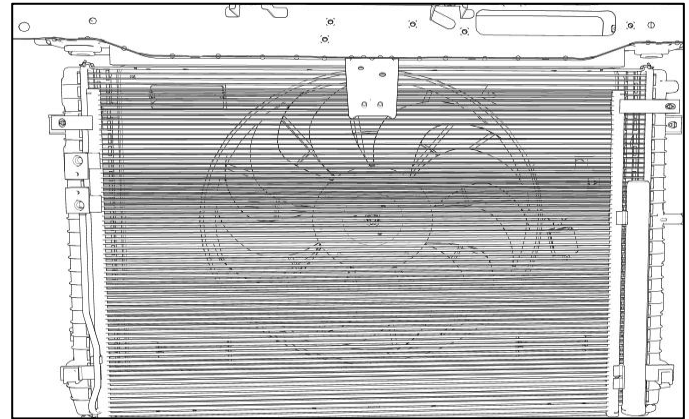
1. Disconnect the negative battery harness.  
[Reference: 3.1.11 charging system](#)
2. Removing air cleaner intake hose
  - 1) .Remove the connecting clamp between the intake hose and the air cleaner housing.
  - 2.)Remove intake hose.



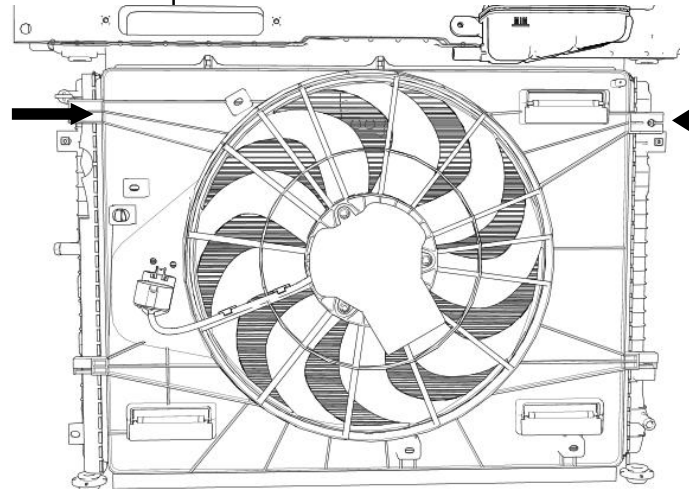
3. Lift the vehicle.  
[Reference: 1.1.3 Towing and lifting](#)
4. Loosen the radiator drain plug and drain the cooling system.
5. Remove upper cooling water pipe (including overflow trachea and water pipe).
6. Remove lower cooling water pipe.
7. Remove front bumper.

[Reference: 5.2.10 bumper](#)

8. Remove the connecting bolts of condenser and radiator.  
Bolt torque: 5.50 NM



9. Remove the connecting bolts of intercooler and radiator.  
Bolt torque: 5.5 NM
10. Remove the connecting bolts of cooling fan and radiator.  
Bolt torque: 5.5 NM



### Installation

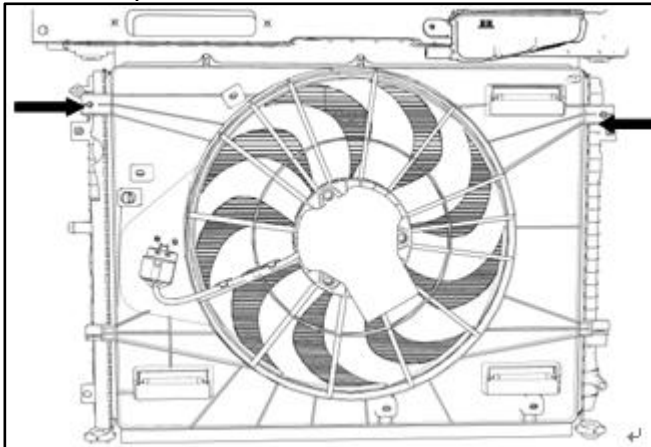
1. The installation sequence is the reverse of the removal sequence.
2. Fill in new coolant.
3. Check the system for leaks.

## Radiator fan

### Removal

1. Disconnect the negative battery harness.
2. Disconnect radiator fan harness bayonet and plug.
3. Remove retaining bolts of transmission oil pipe.
4. Remove 2 retaining bolts of radiator fan.

Torque: 5.5Nm



**⚠ Note:** There are two left and right sides.

5. Take out radiator fan.

### Installation

Installation sequence is reverse to removal sequence

## Water pump



**Note:** The water pump assembly cannot be disassembled.



**Note:** If the water pump needs any repair, replace the assembly and replace the water pump gasket.

### Removal

1. Disconnect the negative battery harness.
2. Loosen the radiator drain plug and drain the cooling system.

[Reference: 3.1.11 charging system](#)

3. Remove front wheel train belt.

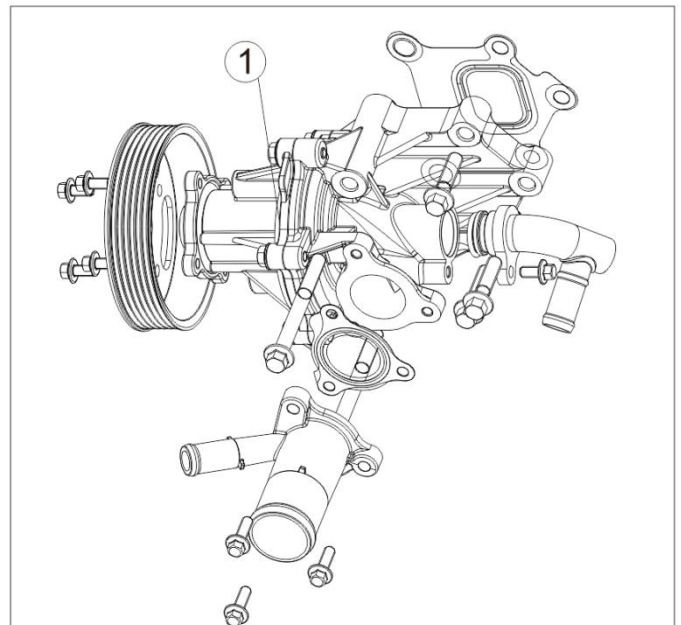
[Reference: 3.1.3 Mechanical system](#)

4. Remove the accessory drive belt tensioner, water pump pulley, HVAC return pipe assembly and water inlet pipe assembly.

[Reference: 3.1.3 Mechanical system](#)

5. Remove the water pump retaining bolts.

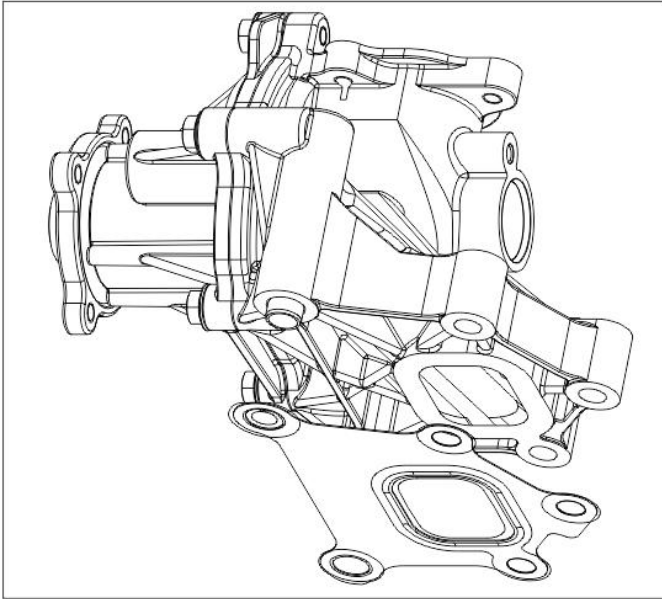
1. Remove the retaining bolts of water pump M8. Torque: 32±2 N.m



6. Remove the water pump assembly.

### Check

1. Check the water pump gasket for damage. If damage is found, replace the water pump gasket.



2. Turn the water pump by hand for flexible operation. If the water pump does not rotate flexibly or there is noise, replace it.
3. Separate the water pump head and pump seat, check whether the water pump impeller is damaged, and replace it in time.
4. Clean the engine cylinder block and water pump joint surface.

### Installation

1. Install a new water pump gasket.
2. The installation sequence is the reverse of the removal sequence.
3. Refill coolant.
4. Start the engine and check the cooling system for leakage and exhaust.



Note: After repairing any parts of the cryogenic cooling system, always open the vent valve on the cryogenic radiator before refilling the antifreeze, and close the vent valve after the antifreeze to be filled spills from the vent valve.



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